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A NEW TRAP-DOOR SPIDER.

BY PROF. GEO. F. ATKINSON.

IN his excellent work on trap-door spiders Mr. Moggridge says: "There would doubtless be a just feeling of pride and satisfaction in the heart of a naturalist, who could say that he had made himself thoroughly acquainted with all the species of a particular group of animals, had learned their most secret habits, and mastered their several relations to the objects, animate and inanimate, which surrounded them. But perhaps a still keener pleasure is enjoyed by one who carries about with him some problem of the kind but partially solved; and who, holding in his hand the clue which shall guide him onwards, sees in each new place that he visits fresh opportunities of discovery. The latter is certainly the condition of those who take an interest in searching out the habits and character of the trap-door spider."[1]

While many interesting facts in the life-history and architecture of trap-door spiders were observed and collated by Mr. Moggridge, he very modestly says that many remain yet to be gathered in; that we are only on the threshold of discoveries of these creatures, who have lain quietly in the earth century after century, and that he will be satisfied to have been able to "hold the door sufficiently ajar to permit those who love nature and her ways to catch a glimpse of the wonders and beauties of the untrodden land that lies beyond."[2]

A favorable circumstance afforded me an opportunity for making some observations on the unseen "wonders and beauties

[1] Harvesting Ants and Trap-door Spiders, Supplement, p. 180.
[2] Harvesting Ants and Trap-door Spiders, p. 136.

of the untrodden land" which is the abode of these interesting creatures, and it is with a sense of pleasure that I note them.

Some time in the latter part of May or early part of June, 1885, Mr. Merritt, of Pittsborough, N. C., brought to Chapel Hill two trap-door spiders with their nests, and placed them in the care of Professor Holmes for the University of North Carolina. The nests with their occupants were placed in the ground for the summer. On Nov. 12, after a careful search, Professor Holmes was able to find only one, and this one with difficulty, as for some reason it had dug through the lower end of the tube and was hidden in the earth. Later I shall offer what seems to me may be an explanation of this. On the morning of the same day the spider with its trap-door nest was placed in my keeping, which was the first intimation I had of the presence of such an agreeable neighbor.

At 4.30 P.M. I placed three and a-half inches of earth in a glass jar five inches in diameter and seven inches deep. Two-thirds of the surface of the soil was then covered with moss. In this the spider was placed, and the jar and its contents taken to my room, that I might, if possible, observe the operation of digging the tube and making the trap-door.

The results were most gratifying. Just before going to supper, at dusk, I observed that the spider had not undertaken the work. Upon returning, at 8.30 P.M., I found the task undertaken. The spider was resting in a hole about 20^{mm} deep by 22^{mm} in diameter, which she had excavated at one side of the jar. I placed the jar upon my study table, just beneath the light of a student lamp, so that while reading I could observe any movements made by my companion. The spider was resting in the hole with its legs partially folded, the anterior ones lying upon the edge of the excavation.

After I had been quiet for some time the spider began to move cautiously, and turning about slowly went head first into the hole, and dug from the bottom with her mandibles a pellet of earth about the size of a small pea. Then turning carefully around she placed it at the edge of the hole, where she pushed it off with the aid of her palpi, at the same time working her mandibles up and down. At first the spider seemed timid, and would cease operations upon the slightest movement on the part of myself. During the course of the evening three other

persons, who came to my room, had the fortune to witness the operation of digging out the earth. The spider soon became bold, paid no attention to movements in the room, and permitted me to watch her very closely. Occasionally, by using both palpi at once, the dirt was flirted suddenly from the grasp of the mandibles with such force as to strike against the opposite side of the jar. Had it not been for this obstruction the dirt must have been thrown three or four feet.

After depositing each load on the edge of the hole, the spider would turn around again for another load, but before picking it up she would project the posterior pair of spinnerets about 5^{mm} from the abdomen and carefully knead the viscid liquid upon and around the freshly placed pellet of earth and over the edge for a distance of 4 or 5^{mm} for the purpose of making the soil adhere and prevent its caving in. In Plate XXIII, Fig, 4, the spider is shown in the act of removing a pellet of earth from her mandibles. In Fig. 5 is represented the application of the viscid liquid. The ends of the spinnerets are applied to the surface alternately, as shown in the illustration. The legs took no part in the application of the viscid liquid; nor did the liquid form a thread when the spinnerets were drawn from the surface, as I have since seen it when the spider was crawling about on the surface of the earth.[1]

At 11.30 o'clock, when the hole was about 4^{cm} in depth, to my surprise and pleasure the spider began to make the "trap door." Standing upon its fore feet and placing the spinnerets against the glass jar at the level of the edge of the hole, the spider covered the glass with the viscid liquid. Several pellets of earth were stuck to this, each time another portion of the viscid liquid being applied. After a depth of 5^{mm} had been built up in this way, which was to answer as the hinge, the spider cut a sprig of the moss and cemented it to the hinge so that the end projected above it. Small sticks, particles of moss and earth were constantly placed upon the edge of the growing door. Each time the spider would come out of the hole for new material, retreat backward, and turn half way around so as to apply it to the door. Placing the load

[1] As I am now writing, Jan. 16, 1886, 11.55 P.M., the spider is crawling about on the surface of a freshly prepared jar of earth. Sometimes the viscid liquid adhering to some object is drawn out in a band of silk 2^{mm} wide, and the pieces of moss strewn on the earth are loosely matted together in the path of the spider about the side of the jar.

on the under side of the partial door, she would carefully move it up to the edge. Then placing the distal portion of the palpi and anterior pair of legs above, while the proximal portion of these limbs and the ends of the mandibles were on the under side of the pellet and door, she would fit and press it in shape, as one would mold with the hand a moist portion of earth by pressing it into a thin sheet. This is illustrated in Fig. 7, Plate XXIII. Indeed it looked very much like the black bony fingers of a hand performing the work of pressing. The greatest pressure seemed to be brought to bear upon the rounded ends of the mandibles. After fastening on a portion thus, the spider would take an inverted position and apply viscid liquid along the edge and under the surface of the door, as shown in Plate XXIII, Fig. 6. She would then turn about and crawl out for more material. The hole being by the side of the jar, I could watch the operation both in the hole and upon the cover. By one o'clock in the morning (Nov. 13) the door was finished so that the spider could pull down the lid, which completely closed the entrance, nicely fitting in around the edge and appearing as if there was no hole nor spider, but through the glass the spider could still be seen.

At intervals during the construction of the door the spider would pull it down to observe where the next pellet should be placed in order to make the door fit the circular opening of the tube. Discovering this she would turn completely around, and not being able, with her head in the bottom of the tube, to see the place where she intended to put the next load, she would find it by feeling about with her spinnerets. The viscid liquid would then be applied and the pellet of earth fitted with extreme nicety.

Satisfied with the result of my experiment I retired. By daybreak I found that the excavation was continued after the completion of the trap door, the soil being deposited around the nest to raise the surface of the earth in the jar to a level with the top of the nest. Without close searching it was impossible to detect the door.

The mode of making the trap door by this spider differs very widely from that observed by other naturalists so far as I can find any record. Mr. Moggridge saw the female, *Nemesia meridionalis*, construct a trap door in captivity. He made a cylindrical, hole in a flower-pot of earth. Into this the spider disappeared. "During the night following the day of her capture she made a

thin web over the aperture, into which she wove any materials which came to hand. The trap door at this stage resembled a rudely constructed, horizontal, geometrical web, attached by two or three threads to the earth at the mouth of the hole, while in this web were caught the bits of earth, roots, moss, leaves, etc., which the spider had thrown into it from above. After the second night the door appeared nearly of the normal texture and thickness, but in no case would it open completely, and it seemed the spider was too much disgusted with her quarters to think it worth while to make a perfect door."[1]

He also records the making of a door by a very young one of this species, in which the threads, except at the hinge, were cut so that the door would open and shut.[2]

The only thing he records which seemed at all analogous to the mode of making a trap door exhibited by the spider in my possession is that manifested in the enlargement of nests and trap doors by spiders as they grow larger, and consequently require nests of larger dimensions. This operation was not witnessed by him, however, but the additions to the size of the door were proven by measurements and observations upon nests of young spiders at different seasons.[3]

It would seem natural to suppose that in making slight additions from time to time to the edge of the nest, the spider would cement pellets of earth, pieces of moss, etc., to the edge instead of first spinning a web; unless the web is spun over the lower side of the door and made to project just far enough to fit the enlarged tube. In Plate XXIII, Fig. 8, can be seen eight concentric "lines of growth," as they might be termed, of the trap door, corresponding to the growth and needs of the spider. These I judge to represent the successive enlargements of the door concomitant with the enlarging of the tube. We can safely say that these additions were made by cementing the material, piece by piece, which forms each ring, to the edge of the door. These "lines of growth" are not present in the door made by the adult spider in captivity. I induced the spider to make the door the fourth time (Jan. 19, 1886) in order to observe if there was any regularity in the cementing of the particles, which might form

[1] Harvesting Ants and Trap-door Spiders, p. 118.
[2] Idem, p. 119.
[3] Idem, pp. 123, 127 and 150, and Supplement, p. 245.

these lines of growth in a door made by an adult spider. There is no such regularity. Indeed, this last door was made of about a dozen very large pellets of clay which, being very plastic, the spider was able to press each pellet into a sheet of considerable dimensions.

It is to be regretted that Mr. Moggridge did not have the opportunity of observing the manner of enlargement of trap doors made by the spiders which he studied, or that he did not offer some theory as an explanation. If the particles are cemented to the edge, it would be quite natural that the species of spider in my possession once made its door by first spinning a web across the mouth of the tube, and then weaving into it other material, as in the case of *N. meridionalis*, and that the habit, followed through life and successive generations, of making additions to the door by cementing particles to the edge, finally became so fixed that this mode of making additions to it became the permanent habit and type of construction of the trap door from the foundation! The rapidity, ease and intelligence manifested in this method of building up the door, piece by piece, certainly indicates a higher development of instinctive power. A perfect and neatly fitting and swinging door made in 1½ hours!

When I took the spider from her nest it was necessary to remove nearly all of the soil from the jar and take her from the lower end of the tube, as all efforts to attract her from the nest failed. As the soil was very loose and the nest not long made, the walls of the tube collapsed. In ten days the spider was returned to the nest. Though the trap door was capable of being used, and seemed to satisfy the spider's idea of the "fitness of things," it was in a very dilapidated condition. This agrees with what Mr. Moggridge says of the reluctance manifested by spiders to abandon an old nest. The examples cited by him are, that if a door be pinned back during the night, a second door will be made; that if the nest be covered with earth, the tube will be prolonged to the surface of the superimposed earth and a new trap door will be made; and that in some cases nests become inverted, when a door being made at the now upper end of the tube, the nest will have a door at each end.[1] The conduct of my spider under another condition farther illustrates this feature. Wishing to observe the habit of the spider, if possible, while the

[1] Harvesting Ants and Trap-door Spiders, pp. 121 and 122.

door of the nest was closed, I prepared a glass test tube, 17^{mm} in diameter, by placing 4^{cm} from the mouth a cork bottom, so that the spider might have something on which to stand while making the door. This, with the spider in it, I placed in the glass jar and surrounded it with earth to darken the walls, hoping thus, because of the firm smooth surface of the tube, she would not line it with silk, and by lifting the tube from the soil I could observe the position of the spider as it held down its door. The experiment was a decided success.

This was prepared at eleven o'clock on the night of Dec. 27 '85. Pieces of moss were strewn about the tube. By morning a perfectly fitting door, beautifully covered with moss, had been constructed (Plate XXIV, Fig. 3). About this time many visitors came to see the spider, and in pulling at the door to show how persistently she would resist its being opened, the hinge became loosened and the door was pulled down upon her. She held on to the door with such tenacity that I pulled it into bits in my efforts to remove it from her grasp. It was removed Dec. 30, '85, and on the following night she built another as neatly as the first. The hinge to this became loosened and the door moved down about 5^{mm} from the mouth of the tube. Here she strengthened the hinge by spinning a broad piece of silk, the width of the hinge, from the door down on to the wall of the tube. Several times in endeavoring to open the door I tore pieces from its edge, and in every instance the spider repaired it. Finally, when I wished to remove her from the tube I was obliged to push up on the cork bottom, and in this way crowd her out through the door. After this was done it was with some difficulty that she freed her posterior feet from the silk bag which she had constructed at the bottom, so firmly did she hold on.

I have this yet to add. In a note I have mentioned the wandering of the spider about in a jar of freshly prepared earth, Jan. 16. For three days she has been restless, and though several attempts have been made to dig a tube she had failed. I came to the conclusion that the soil was not such as she could work easily or satisfactorily. Wishing to have soil which would make a more durable tube than the loose soil in which I saw the first nest made, I used a large proportion of fine plastering sand mixed with black earth. This was wetted, and pieces of moss strewn over the surface. She tried several times to take up pellets of the

earth, but seemed to be disgusted with its crumbling. She then tried to bore a hole by pushing down with her mandibles while turning her body around. She evidently wished to hide her head from the light, for after making a hole 2^{cm} deep she remained with her head at the bottom. To-day, Jan. 14, '86, the soil in the woods having thawed sufficiently, I prepared a jar of moist ferruginous clay, very much like that of which the nest is constructed that came from Pittsborough. Upon this I put a fine mat of fresh moss, covering the earth except a spot at one side $2\frac{1}{2}^{cm}$ in diameter. In this I placed the spider at noon. I then covered it from the light. As I returned to my room after dinner, she was resting in a hole 3^{cm} deep which she had excavated, and small pellets of earth were placed against the moss at the mouth of the hole. She would not work during the day unless I covered the jar from the light. During the evening, by lamp light, I had the pleasure of seeing her make another door. It required about one and a half hours. Only one piece of moss was used, and that I let drop into the hole while she was at work. This seemed very strange, for the tube was the only place not covered with moss, and to save her the trouble of cutting the moss I had strewn loosened particles about the hole. In this case all of the earth used in the construction of the door was taken from the bottom of the hole. The door being made almost entirely with the clay was very conspicuous in comparison with the surrounding moss; though the door fitted very neatly, the tube being built up to a level with the top of the moss. This time instead of making the hinge against the side of the jar it was made on the opposite side of the tube. Surely this persistence is equal to that shown by the spider who, making her web the thirteenth time, taught a general lesson of perseverance.

I was unable to understand how the resistance to opening the door was offered, if the spider fastened its fangs and *all* of its claws into the under surface of the door, as Mr. Moggridge states.[1] A reference to Plate XXIV, Figs. 3 and 4, will show the results I reached in the experiment when the spider was induced to make a trap door to the mouth of a glass test tube. The portion of the tube from *b* to *c* was not lined with silk. The spider, evidently not admiring the cork at *d* for a bottom to her nest, carried in pellets of earth and bits of moss as shown at *g*. She

[1] Harvesting Ants and Trap-door Spiders, pp. 95–96.

then spun a short bag of silk, *f*, which was attached by the mouth to the walls of the tube at *c*, and rested on the piece of of cork. The mouth of the test tube was lined with silk from the edge for about 5^{mm} to 7^{mm}. The ends of the silk lining at *b* and the silk bag at *c* were for some distance transparent, so that I was enabled to see the spider fairly well. As can be seen in Fig. 4, the spider clings to the bag of silk at the bottom (or walls of the tube) with the claws of her two posterior pair of legs, and to the under surface of the door with her fangs and the claws of her anterior pair of legs. By partially lifting the door I was enabled to see the hold upon the door, and when I pushed the spider out of the tube, as before stated, I found her feet entangled in the bag of silk. The manner in which this spider holds down the door is precisely the same as that described by Emerton[1] in the case of *Cteniza californica*, except that he states the "third and fourth pairs of legs are pressed out against the walls of the tube."

The nest of this spider belongs to the simple, unbranched type with shallow cork door. The door belonging to the nest in which the spider was caught (Plate XXIV, Fig. 1) measures 3 to 4^{mm} in thickness; the edge is beveled and fits neatly in the mouth of the tube. The door measures 25^{mm} across near the hinge; the tube 60^{mm} in length. The walls are badly collapsed, and the lower edge ragged and open. It will be remembered that the spider was found in the earth below the tube when the nest was taken up in November. The first nest which the spider made under my observation was left open at the bottom, and when I attempted to take her out, finding she could not hold down the door, she attempted to bury herself in the soil at the bottom of the tube. The question naturally arises, Is this not left open as a last means of escape from enemies? I am inclined to think it is, in some cases at least with this species, as this is the only resort for safety after the door is open. Further observation is needed on this point.

The trap door of this nest is so hung that it tends to close itself. In Fig. 2, Plate XXIV, at *a* are patches of silk that are drawn on the stretch when the door is open. When all resistance is removed these tend to close the door.

The subject of the food of trap-door spiders is an interesting

[1] Structure and Habits of Spiders, p. 45.

one, and much is yet to be learned of their habits in this respect. While I had the spider out of her tube I offered her several house-flies, holding them by one wing with the forceps near her head. The struggles of the fly attracted her attention. With a quick sweep of the palpi and anterior pair of legs she would clutch the fly and place it between her powerful mandibles, crushing it immediately.

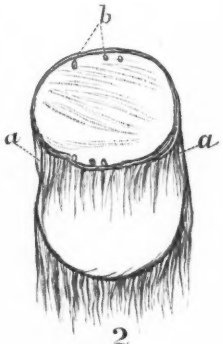
She held some of these about one minute, but I very much doubt her having derived any nourishment from them. One of the smaller species of the flies belonging to the genus Tabanus was offered her. It seemed only to frighten her, as she could not be made to touch it even by being angered, but would turn and run away as if in great fear. After returning the spider to her nest, Dec. 8, I placed in the jar two ants and a small carabid beetle. The ants hid themselves in the earth. Dec. 14 the beetle was still unharmed, and I concluded the spider did not come out for food. I then lifted the trap door and placed the beetle inside. Dec. 16 I found the broken hard parts of the beetle strewn about just outside the nest. It had been killed, the soft parts eaten by the spider, and the parts of the skeleton ejected from the nest. Jan. 17, '86, I placed a half dozen large yellow ants in the jar.[1] As they attacked her she would catch and crush them, but I did not see that she ate any of them.

Jan. 2, '86, which was almost like a summer day at Chapel Hill, I went into the woods for the purpose of collecting some moss. While tearing up a large patch of this at the foot of a tree, I discovered a hole which I thought to be the nest of a trap-door spider. I dug down into the tube and found at the bottom a spider belonging to this family. In the afternoon I found several nests and one more female spider. Under some stones I found a male. I placed them in jars of earth containing moss. One of the females escaped, the other built a nest and made a slanting double door which might be compared to an outside cellar door. Each door is made of moss cemented with silk and hung by a semicircular hinge. These the spider will open and shut at pleasure, sometimes fastening them together with a thread of silk. In both of the nests in which I found these spiders there were the remains of ants. I had intended to illustrate and describe farther the nests and habits of these found by myself at

[1] The spider was not in her nest.

PLATE XXIV.

1



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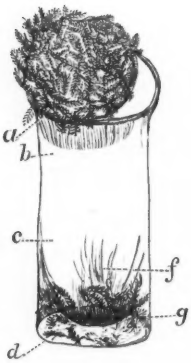

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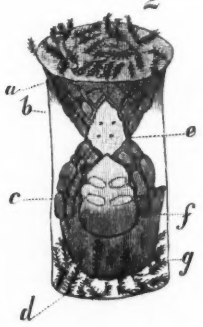

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G.F. Atkinson. del.

A new Trap-door Spider.

Chapel Hill, as they are lively creatures and seem to offer interesting objects for study as to habit, food and architecture. But as this article is already long, and I wish to make farther collections and study their habits more closely in captivity, I will reserve the subject for a future time.[1]

EXPLANATION OF PLATES.

PLATE XXIII.

FIG. 1.—Spider, natural size, dorsal view.
" 2.— " " ventral "
" 3.— " " side "
" 4.—Spider in the act of unloading a pellet of earth while excavating the tube. *a*, pellet of earth.
" 5.—Spider applying viscid liquid to the freshly placed pellet of earth. *a*, spinnerets.
" 6.—Spider applying viscid liquid to the edge of the partially constructed door. *a*, spinnerets; *b*, door; *c*, pieces of moss.
" 7.—Spider in the act of fitting to edge of the door a pellet of earth, *a*.
" 8.—Trap door showing eight concentric rings which represent the successive additions to the edge of the door corresponding to the enlargement of the tube. *a*, hinge.

PLATE XXIV.

FIG. 1.—Natural size of nest in which the spider was caught.
" 2.—Trap door open. *a*, bands of silk which tend to close the open door; *b*, claw and fang marks of spider made while holding down the door.
" 3.—Nest made in glass test tube. *a*, hinge; *f*, bag of silk; *d*, cork bottom; *g*, pieces of moss and earth.
" 4.—Spider in act of holding down the door while in the nest. All natural size.

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A FEW LEGENDARY FRAGMENTS FROM THE POINT BARROW ESKIMOS.

BY JOHN MURDOCH.

DR. Rink, in his "Tales and Traditions of the Eskimo," has already called attention to the fact that among the rare cases that we have of any Eskimo tradition from the western regions, in what is now the territory of Alaska, there is one legend, that of the sun and the moon, which is identical with a well-known Greenland tradition (p. 237), and from this draws additional evidence of the identity of the Eskimo race over this extensive region.

The following fragments of stories were collected by the writer

[1] A description of these spiders I reserve for a future time when a fuller collection is made and habits more clearly observed.

and other members of the United States International Polar Expedition from the Eskimos of Point Barrow, Alaska, which is the extreme north-western point of the continent of North America, during a stay of two years (from 1881 to 1883). The fact that several of them show features indicating a relationship with well-known Greenlandic stories seems to the writer to render them, scanty as they are, worthy of publication.

Two or three of them have already been published by Lieut. Ray, the commander of the expedition, but as they appeared in a government publication,[1] perhaps not accessible to all readers, it will not be out of place to repeat them here.

Occupied as our party was with the manifold routine scientific work of the station, it was exceedingly difficult to get hold of any of the traditions of the natives, though they showed no unwillingness, from superstitious or other reasons, to talk freely about them. In the first place there were so many (to the Eskimos) more interesting things to talk about with us, that it was difficult to bring the conversation round to the subject in question. Then our lack of familiarity with the language was a great hindrance to obtaining a connected and accurate version of any story. The jargon, or kind of *lingua franca*, made up of Eskimo roots and "pigeon English" grammar, which served well enough for every-day intercourse with the natives, enabled us, with the help of expressive gestures, to get the general sense of the story, but rendered it impossible to write down an Eskimo text of the tale which could afterwards be translated. Moreover, the confusion and difficulty was still further increased by the fact that two or three people generally undertook to tell the story at once.

In writing out the following stories I have endeavored to avoid introducing ideas and expressions of my own, and to adhere as closely as possible to the simple sense of the brief disconnected sentences of the narrators.

1. How people were made. Long ago, Aselu, a dog—"where he came from I did not hear"—was tied to a stick. He bit the stick [*i. e.*, set himself free] and went into the house, where he had intercourse with a woman, who gave birth to men and dogs.

The belief that a dog was one of their remote progenitors is a very common one among savages. According to Egede (Green-

[1] Report of the United States International Polar Expedition to Point Barrow, Alaska. By P. H. Ray. Washington, 1885.

land, p. 195) the Greenlanders believed that white men were the offspring of a similar union between a woman and a dog. (The same story is also referred to in Rink's "Tales," &c., p. 471.)

2. Another account of the origin of human beings. In the east, a tall tube [like a reed. The narrator to illustrate this pointed to one of our bamboo fishing-rods] stuck up from the ground. A man broke the tube. "Behold, many men and women!"

3. The origin of reindeer and fishes. Both reindeer and fishes were made by a mythical person of whom we got only a vague account, though he was often mentioned. He was said to be a little man with long tusks like a walrus, and many of the little Eskimo figurines and masks of ivory, soapstone or wood, which we brought home from Point Barrow, represent such a being, and are, perhaps, meant for images of this person.

When the deer was not, this man made one out of earth. The deer all had large teeth in the upper jaw and were "bad"—they bit people. So he said to them: "Come here!" and when they came he pulled out these teeth. Now they are "good."

The reindeer, of course, like the sheep and other ruminants, has no incisor teeth in the upper jaw, and this myth is certainly an ingenious way of accounting for this fact, which must have seemed very strange, since all the other animals known to the Eskimos are well supplied with teeth in both jaws.

When the fish were not, this man hewed a piece of wood by the river side with his adze. The chips fell into the water and were fishes.

There seems to have been a similar myth in Greenland. According to Crantz: "They say fishes were produced by a Greenlander's taking the shavings of a tree, drawing them between his legs and casting them into the sea" (History of Greenland, Vol. 1, p. 204); and Egede tells a similar story (Greenland, p. 196).

4. Thunder and lightning. It rarely thunders at Point Barrow, but the natives know what these phenomena are and account for them as follows: Long ago a grown person and a child went up into the sky, carrying a dried sealskin and torches of tar. With these they make the thunder and lightning, apparently by waving the torches and rattling the sealskin.

Dr. John Simpson, the surgeon of the *Plover*, the English discovery ship that wintered at Point Barrow thirty years before us,

gives a version slightly different but agreeing in the main with this.

Evidently related to this is the Greenland tradition referred to by Crantz (Vol. I, p. 233) that the thunder is caused by "two women stretching and flapping a dried sealskin." Egede (p. 207) gives the story in greater detail. The thunder and lightning are made by two old women who live in a house in the air. They now and then quarrel about a dried sealskin, and while they are fighting down comes the house and breaks the lamp, so that the fire flies about.

5. The story of the Kokpausina. Long ago there were five very strong brothers, Kokpausina, Kokkaun, Inaluoktuo, Nimna and Pûkanigarua. (The narrators were particular to impress it upon us that these men were not especially tall, but very stout and strong. The strength of Kokpausina especially seems to have become proverbial, for an Eskimo once compared the great, powerful hand of an old whaleman, one of our party, to that of Kokpausina.) Kokpausina lived at Pernye [*i. e.*, "the elbow," the summer campground in the bend of Elson bay, between Point Barrow and the station], Kokkaun east of Point Barrow on the seashore, Inaluoktuo inland in the south, Nimna at Dease inlet, and Pûkanigarua at Cape Smyth. Kokpausina found two little orphans asleep and thrust excrement up their noses [apparently from sheer malevolence, though we never succeeded in making the natives understand that we wanted to know the reason of this action.] So they went home and made a little bow and arrows, short enough to hide under the jacket, but strong enough to shoot through a walrus-hide dried before the fire [and therefore nearly as hard as iron]. Then they went to Pernye and saw Kokpausina, with his back towards them, stooping over. So they shot him in the buttocks and the arrow came out at his collar bone, and he died.

His great shoulder-blade and some of his other bones are still at Pernye. [Natives who came down from the Point Barrow village to the station once or twice told the writer that they had seen Kokpausina's bones at Pernye on their way down. One went so far as to bring us down a rather large human jaw bone from the old cemetery near Pernye, saying that it was Kokpausina's.]

This story, which we heard from several narrators without any

essential variation of names or incidents, and without being able to get more details, is the skeleton of one of the semi-mythical traditions so common in Greenland, which may really refer to some actual occurrences in ancient times, but which have been localized and adapted to suit the region in which the narrator lives.

The death of Kokpausina bears a strong resemblance to the final catastrophe of the Greenland story of Kagsuk (see Rink's "Tales," &c., p. 431), which is said to have taken place in Greenland, in the districts of Holsteinborg and of Sukkertoppen, and according to Dr. Rink is perhaps a variant of an older tale only localized in this way. In this story the wicked Kagsuk, after committing various deeds of violence, at last murders the sons of *two* old men "clever in magic spells." To revenge themselves they prepare "bows of an *arm's length*," and while others engage Kagsuk's attention in front they creep up behind, escaping observation by magic, and shoot him dead.

It seems hardly too bold a statement to say that if Kagsuk and Kokpausina were real persons at all they were one and the same man, who lived neither at Sukkertoppen nor at Pernye, but somewhere in the common home of the prehistoric Eskimos, before the Greenlanders started on their weary journey towards the east and the men of Point Barrow on their perhaps longer journey towards the setting sun.

It is interesting to note that the *five* very strong and (apparently) wicked brothers who appear in this story are evidently the same as the "band of five brothers, generally called 'a lot of' brothers or men" who, according to Dr. Rink, figure in so many of the Greenland tales as the personification of haughtiness or brutality.

6. A murder at Cape Smyth. Udlimau was once given as the name of one of Kokpausina's four brothers, but the narrator afterwards corrected himself and said, as did other natives also, that Udlimau was a bad man who long ago lived at Utkliavwing (Cape Smyth) and who murdered Kumnero as he lay asleep beside his wife by cutting him across the bowels. The house where this murder was committed was pointed out to us in the village. This is probably an account of an actual occurrence, as is the following:

7. The people who talked like dogs. Long ago, when there

was no iron, five families had their houses at Isûtkwa (the site of the signal station, where several mounds indicate the position of the former village). They were called Isûtkwamiun ("they who live at Isûtkwa"), and they talked like dogs. They said "imeklunga, wa! wa!" ("I want a drink, bow-wow!").

The following fragment, however, for which Lieut. Ray is my authority, and which was also related to Dr. Simpson thirty years before, which both these gentlemen think indicates that these Eskimos are really acquainted with an unexplored land in the north, is in my opinion more probably referable to the same category as the numerous tales of the eastern Eskimo about the mythical land of Akilinek.

8. Iglu Nuna ("House country"). In the north is a country where the Iglumiun live. When all men wore *one* labret [the characteristic lip-stud of the western Eskimos, of which a pair is now universally worn in the under lip, one at each corner of the mouth. The expression means a very long time ago, as the single labret has long been out of fashion, and a few only are preserved as heirlooms or amulets], a man with his sledge and dogs lost his way on the ice and traveled many days till he came to a country he had never seen before, where there were people who spoke his language.

We also heard of various fabulous animals, though in many cases the names which in Greenland are applied to animals known only by tradition, and which therefore have grown into fabulous monsters, are still used for the animals to which they properly belong, as in Labrador and elsewhere, for instance, *amaro* means the wolf, and *avwinga* the lemming, while in Greenland the *amarok* and *avingak* are semi-supernatural creatures that figure in many of the old stories.

The Greenlandic word *kilivfak* or *kiliopak*, which there means an animal with six or even ten legs, appears at Point Barrow as at the Mackenzie river in the form *kiligwa* as the name of the mammoth or fossil elephant (see also Rink, "The Eskimo Dialects," Journal of the Anthropological Institute of Great Britain, November, 1885). We heard none of the fanciful myths about this animal which have been reported by various travelers from the shores of Bering sea, but the word was in common use, especially as the name of the fossil ivory, which is very plenty and much used by the western natives for various purposes.

It is interesting to note in this connection that one of the little ivory images brought home by our party from Point Barrow represents a bear with *ten* legs, said to have been seen once at Point Barrow, and evidently a blood relation of the many-legged *kilivfak* of the Greenland stories.

Another fabulous beast was the *ugruna*. "There are none now on the land. It has gone away, only the bones [remain]." This name appears to be applied to an extinct species of ox or buffalo, whose bones they sometimes see in the interior, probably along the banks of the rivers. We procured several teeth of the *ugruna* which had been worn as amulets. As in Labrador this name is also applied satirically to the smallest mammal known to the Eskimos, a little shrewmouse.

As elsewhere on the American continent, the Red Indian, who in Greenland, like the wolf, has become a fabulous being, dwelling in the mysterious inland country, is called by the contemptuous name, "son of a *nit*"—Itkûdling, the Ingalik or "Ingaleet" of Norton sound, which is plainly the same word as the *erkilek* of the Greenland traditions.

Outside of the strict field of legendary history or tradition, the religious ideas and superstitious observances of these people, as far as we had the good fortune to observe them, show a great resemblance to those of the Greenlanders before their conversion to Christianity. So strong is the resemblance in this and in other respects that I feel confident that an intelligent observer who should devote himself to the collection of the traditions of the Eskimos of Point Barrow, as Dr. Rink has so ably done for the Greenlanders, would find here the greater part of the older traditions of the Greenlanders in a recognizable shape.

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HISTORY OF CELERY.

BY E. LEWIS STURTEVANT, M.D.

IF we consider cultivation as embracing only the removal of a plant to fertile soil and its protection from injury from crowding, the only marked effect of the continuance upon a plant through itself and its offspring seems to be embraced in the one word expansion, *i. e.*, increase of size. If we enlarge the meaning of cultivation so as to embrace selection and the cross-fertilization of the flowers which yield seed for future use, the subject

becomes more complicated, and we find it difficult in all cases to connect the sequence of cause and effect. One fact, however, through careful observations, seems undoubtedly true, that by selection alone, without the assistance of the break caused by a cross-fertilization, changes in our plant are extremely slow, and many generations are required to obtain and fix any change other than increase which is sufficient to be noted by the casual eye. In support of this view we can direct attention to the little change that has been produced by centuries of culture in those plants which represent but improved forms of a wild species, such as the parsnip, scorzonera, salsify, etc., among roots; and we may also call attention to the stability of type-form during centuries of culture in the eggplant, pepper, and I may even add the pumpkin. Perhaps one of the most interesting instances of increase of size without change of type can be seen in the watermelon. The old herbalists figure this fruit of small size, but as is very likely, only small varieties were commonly grown in Europe. John Bauhin, whose history of plants was published in 1650, many years after it was written (he died in 1613), states the watermelon to be so large that one could scarcely embrace it with the two hands, "quos fere ambabus manibus ambias." Marggravis, whose history of natural productions of Brazil was published in 1648, describes the watermelon as being as large as one's head, "magnitudine capitis humani."[1] That our present types of fruit were then known is evidenced in many ways, but can be given succinctly by Caspar Bauhin's statement in his Pinax, edition of 1623, that some have a green skin, others a skin spotted with dingy white; the flesh of some red, of others white; the seeds black, red and tawny, in varieties. Ray describes the fruit as round, or globose or even elliptical. In modern times we have fruit so large that my arms cannot embrace the oval, and a weight of ninety-six pounds has been claimed, probably with justice.

In seeking for a good illustration of the stability of type joined with a change produced by cultivation and selection, I have taken the celery, as this vegetable seems to be of modern

[1] Cardanus, however, in his de rerum varietate, 1556, apparently refers to a watermelon, "Magnitudo quandoque tanta, ut homo expansis brachiis vix una amplecti queat;" but then Cardanus was dealing with wonderful things! He calls it "Anguria, qua melopeponem ob it Galenus vocat, quod non distincta sit canalibus ut pepon sed rotunda ut pomum."

origin, and the variations from the wild plant have been apparently deemed great, although really but slight, except in expansion produced by freedom of growth and changes which have slowly accumulated through selection.

The celery has originated from the *Apium graveolens* L., a plant of marshy places whose habitat extends from Sweden southward to Algeria, Egypt, Abyssinia, and in Asia even to the Caucasus, Beloochistan and the mountains of British India,[1] and has been found in Fuegia,[2] in California[3] and in New Zealand.[4] It is supposed to be the *selinon* of the Odyssey, the *selinon heleion* of Hippocrates, the *Eleioselinon* of Theophrastus and Dioscorides and the *Helioselinon* of Pliny and Palladius. It does not seem to have been cultivated,[5] although by some commentators the word interpreted as smallage has a wild and cultivated sort. Nor do I find any clear statement that this smallage was used as food, for *sativus* means simply planted as distinguished from growing wild, and we may suppose that this Apium, *if* smallage was meant, was planted for medicinal use. Targioni-Tozzetti[6] says this Apium was considered by the ancients rather as a funereal or ill-omened plant than as an article of food, and that by early modern writers it is mentioned only as a medicinal plant. This seems true, for in the books in my library I find that Fuchsius, 1542, does not speak of its being cultivated, and implies a medicinal use alone, as did Walafridus Strabo in the ninth century; Tragus, 1552, likewise; Pinaeus, 1561; Pena and Lobel, 1570; also Ruellius' Dioscorides, 1529; Camerarius' Epitome of Matthiolus, 1586, says planted also in gardens, "Seritur quoque in hortis," and Dodonaeus, in his Pemptades, 1616, speaks of the wild plant being transferred to gardens, but distinctly says not for food use. According to Targioni-Tozzetti,[7] Alamanni in the sixteenth century speaks of it, but at the same time praises Alexanders for its sweet roots as an article of food. Bauhin's (1623) name, *Apium palustre* & *Apium officinarum* indicates medicinal

[1] De Candolle. Orig. des Pl. Cult., 71.

[2] Ross. Voy. to the South seas, II, 298. *Apium antarcticum*, Cook's Voy., ed. 1769, I, 28.

[3] Nutt. Jour. Acad. Phila., n. ser., I, 183.

[4] Forster. Pl. Esc., 67.

[5] Bodaeus and Scaliger's Theophrastus, ed. 1644, p. 804. Ruellius' Dioscorides, 1529, Pliny. Grandsagne. ed. Palladius, Gesners Script, rei rust.

[6] Hort. Trans., 1854, 144.

[7] l. c.

rather than food use, and J. Bauhin's name, *Apium vulgare ingratus*, does not promise much satisfaction in the eating. According to Bretschneider[1] celery, probably smallage, can be identified in the Chinese work of Kia Sz'mu, the fifth century A. D., and is described as a cultivated plant in the Nung Cheng Ts'nan shu, 1640. We have a mention, however, of a cultivated variety in France by Olivier de Serres in 1623,[2] and in England the seed was sold in 1726 for planting for the use of the plant in soups and broths,[3] and Miller[4] says, in 1722, that smallage is one of the herbs eaten in the spring to purify the blood. The cultivated smallage is even now grown in France under the name of *Celeri a couper*, differing but little from the wild form. The number of names that are given to smallage indicate antiquity, such as Arabic *Asalis*, Italian *apio*, German *Eppich*, Spanish *Perexil dagoa*, French *ache*,[5] Egypt *Kerafs*,[6] English *smallage*, etc.

The prevalence of a name derived from one root indicates a recent dispersion of the cultivated variety. Vilmorin[7] gives the following synonyms: French *Celeri*, English *celery*, German *Selleree*, Flanders *Selderij*, Denmark *Selleri*, Italy *Sedano*, Spain *apio*, Portugal *Aipo*, and M'Intosh[8] gives for the Spanish *Apio hortensis*. The first mention of the word celery that I have observed is in Walafridus Strabo's poem entitled "Hortulus," where he gives the medicinal uses of Apium, and in line 335 uses the word as follows:

"Passio tum celeri cedit devicta medelæ."

The disease then to celery yields, conquered by the remedy, as it may be liberally construed, yet the word *celeri* here may be translated quick-acting, and this suggests that our word *celery* was derived from the medicinal uses. Strabo wrote in the ninth century, having been born A. D. 806 or 807, and dying in France in 849. Targioni-Tozzetti[9] says it is certain that in the sixteenth century celery was already begun to be grown for the table in Tuscany. I cannot find any mention of *celery* in Fuchsius, 1542; Tragus, 1552; Matthiolus Commentaries, 1558; Camerarius' Epitome, 1558;

[1] Botanicon Sinicum, 78.
[2] Ponce. La. Cult. Maraich. Also Heuze, Les Pl. Alim., I, p. 5.
[3] Townsend. Seedsman, 1726, 37.
[4] Bot. Offic., 1722.
[5] Pinaeus, 1561.
[6] Forsk.
[7] Les Pl. Pot., 72.
[8] Book of the Garden, II, 150.
[9] l. c.

Pinaeus, 1561; Pena and Lobel, 1570; Gerarde, 1597; Clusius rar. plant., 1601; Dodonaeus, pempt., 1616; or in Bauhin's Pinax, 1623. Parkinson's Paradisus, 1629, mentions Sellery as a rarity, and names it *Apium dulce.* Ray in his Historia plantarum, 1686, says the smallage transferred to culture becomes milder and less ungrateful, whence in Italy and France the leaves and stalks are esteemed as delicacies, eaten with oil and pepper. The Italians call this variety *Sceleri* or *Celeri.* The French also use the vegetable and the name. He adds that in English gardens the cultivated form often degenerates into smallage. Quintyne, who wrote[1] prior to 1697, the year in which the third edition of his Complete Gardener was published, says, in France "we know but one sort of it." Celeri is mentioned, however, as *Apium dulce, Celeri Italorum* in Hort. Reg. Par., 1665;[2] in 1778 Mawe and Abercrombie note two sorts of celery in England, one with the stalks hollow and the other with the stalks solid; but in 1726 Townsend[3] distinguished the celeries as smallage and sellery, and the latter he says should be planted "for Winter Sallads, because it is very hot." Tingburg[4] says celery is common among the richer classes in Sweden, and is preserved in cellars for winter use. In 1806 M'Mahon[5] mentions four sorts in his list of garden esculents for American use. It is curious that no mention of a plant that can suggest celery occurs in Bodaeus and Scaliger's edition of Theophrastus, published at Amsterdam in 1644.

The summary of our investigation hence is, that we find no clear evidence that smallage was grown by the ancients as a food plant, but that if planted at all it was for medicinal use. The first mention of cultivation as a food plant that I note is by Olivier de Serres, 1623, who calls it *ache,* while Parkinson speaks of *celery* in 1629, and Ray indicates the cultivation as commencing in Italy and extending to France and England. Targioni-Tozzetti states, however, as a certainty that celery was begun to be grown in Tuscany in the sixteenth century. The hollow celery is stated by Mawe[6] to have been the original kind, and is claimed by Cobbett[7] even as late as 1821 as being the best.

[1] Eng. ed., 1704.
[2] Tourn. Inst., 1719, 305.
[3] l. c.
[4] Hort. Culin., 1764, 25.
[5] American Gardeners' Kalendar.
[6] Mawe and Abercrombie. Gardener, 1778.
[7] American Gardener.

The first celeries grown seem to have differed but little from the wild plant, and the words celery and [cultivated] smallage were apparently nearly synonymous at one time, as we find cultivated *ache* spoken of in 1623 in France, and at later dates *Petit celeri* or *celeri a couper*, a variety with hollow stalks cultivated even at the present time for use of the foliage in soups and broths. Among the earlier varieties we find mention of hollow-stalked, stalks sometimes hollow, and solid-stalked forms; at the present time the hollow-stalked forms have become discarded. Vilmorin[1] describes thirteen sorts as distinct and worthy of culture in addition to the *celeri a couper*, but in all there is this to be noted, we have but one type.

A curious circumstance is that smallage took on the appearance of celery before its use was commonly recorded, if at all, as a salad plant, as is evidenced by the drawings herewith reproduced in reduced form. The first drawing is substantially the same as that in Fuchsius, 1542; Tragus, 1552; Pinaeus, 1561; Tabernaemontanus ic., 1590, or Gerarde, 1597, and Dodonaeus, 1616, and is taken from Matthiolus' Commentaries, 1558; this represents the common expression of the herbalists as to the appearance of *Apium palustre* at this time. The second picture is from Camerarius' Epitome of Matthiolus, 1586, and represents the form we call celery, but hollow stalked as at first noticed. The third picture is taken from Decaisne and Naudin's Manuel de l'amateur des jardins, and represents the unblanched plant of one of our most improved varieties. These pictures suggest the same ideas that I have previously shown to hold true for the dandelion, viz., that our improved strains originated from natural sources, and are not cultural in their beginnings.

Take the wild smallage, transfer to fertile soil and protect from crowding, and we should expect increase of size to the plant; earth up for the purpose of blanching and we should expect to gain increased weight to the leaf-stalks; a long-continued selection of the best plants for seed-growers would gradually succeed in forming the solid stalked; the growing of varieties from the earliest seed would tend toward earliness; the occasional growing through accident from unripe seed would tend towards obtaining a curled-leaf form with dwarf habit, etc. We may hence say that all our celeries in form are not changed from the orig-

[1] Les. Pl. Pot.

inal except in unessential points correlated with size and selec-

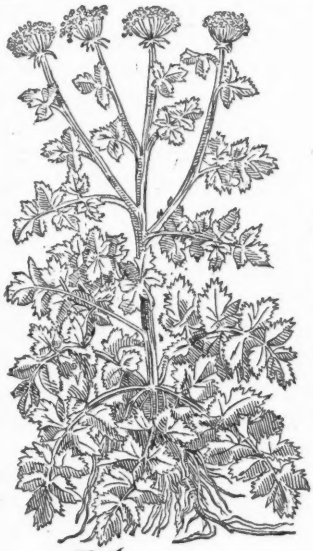


Fig. 1

Fig. 2

Fig. 3

FIG. 1.—*Apium palustre* (Matth. Comm., 1558, p. 362). FIG. 2.—*Apium palustre* (Cam. Epit., 1586, p. 527). FIG. 3.—*Celeri plein blanc* (Decaisne and Naudin).

tion. In quality celeries have tended to become milder, until

now some of our varieties, such as the Boston market, are of a very delicate taste, far different from the sort spoken favorably of by Townsend in 1726 as very hot and very slow growing.

It is probable that some original variation in quality discovered in the wild plant suggested cultivation, for among a people like the Italians, with whom high aromatic taste seems popular, the strong savor of the smallage would present little objection, if only grateful to them; or that its use was suggested by some popular idea of its value as a medicinal food, as seems probable. That there is great variety in wild plants in respect to flavor, we have every reason to believe. Smallage, described by most botanists as a suspicious if not dangerous plant for eating, yet in Fuegia was found palatable and healthful by the sailors of the exploring ships,[1] and in New Zealand described by Forster[2] as truly pleasant and salutary for scorbutic sailors. The use in Italy as a medicinal food, and the introducing to garden culture, with blanching, etc., would improve the flavor and increase its use, and improvement once initiated and recognized would necessarily continue, and stability of type-form would also tend to continue, as the seeding habits of the garden plant is not favorable to cross-fertilization with the wild or allied species, it being a biennial, and not usually seeding alongside of other species with which crosses might occasionally occur.

We have now in celery an improved, not changed, wild plant, which does not now tend to revert to the wild form, as it seemed to have done at the first, and a good illustration of the fixity of a garden form species. The present form will undoubtedly continue unchanged for a long period, unless cross-fertilization with another species-variety is brought to pass. It would be of garden interest to grow and cross the species-forms from different portions of the globe with our garden varieties, as analogical reasoning would suggest possibilities as yet unsuspected in practice.

[1] Ross, l. c. Cook, l. c.
[2] l. c.

THE YELLOW-BILLED MAGPIE.

BY BARTON W. EVERMANN.

DURING two years spent in Ventura county, Southern California, I became quite familiar with this handsome yet noisy bird of plebeian tastes. The yellow-billed species seems to be restricted in its range to California, throughout which State it is locally abundant.

One of the great industries of Southern California is wool-growing; the valleys and hillsides are covered with flocks of sheep, from a score to several thousands in number; and nearly every cañon has its corral to which the herder and his faithful dog drive the flocks at eventide. Here they are shut up and guarded through the night. In the morning they are again turned loose to feed upon the burr clover, alfillarilla (or "fillareé"), and such other stuff as can cause only sheep and mules to thrive. In and about these corrals are various kinds of filth—carcasses of sheep that have died of disease or starvation, bodies of dead lambs and the refuse of the sheep which the herder has slaughtered for his own larder, for jerked mutton and tortillas constitute the chief part of his meager bill-of-fare. Such a place as this is a paragon of restaurants to the magpies. Here they can be found in the early morning, in the evening, and at any other time of day when they happen to be hungry. Here they come to feed upon the filth, keeping up an almost incessant chattering, crying and scolding, which if translated into intelligible English would certainly bristle with oaths and slang. For there, where the English sparrow has not yet found its way, the magpie represents the "hoodlum element" in bird society. But when the English sparrow invades its domain, the magpie will become, by comparison, a most estimable member of the avian fauna of that region.

Almost any cañon which has a considerable sheep corral and is supplied with a few scattered clumps of live oaks, cottonwoods or sycamores, is quite sure to have its colony of magpies. And when you enter one of these cañons you are apt to know of their presence long before you come within gunshot of them, unless they, as is sometimes their custom, remain quiet and hidden until you are near them, when they open fire upon you with volleys of oaths, imprecations and maledictions, which nothing but a charge of shot will stop.

Such a place as this is Wheeler cañon, a few miles down the Santa Clara valley from Santa Paula. By former visits to this cañon I had kept myself informed as to the progress these birds were making in their nesting. So on April 2, 1881, Mr. Fred. Corey and I paid the cañon a visit, believing that many "full sets" would be gotten. We started from home early in the morning and drove down to the cañon, fully prepared to spend the day. As we drove leisurely along the foot of the mountain slope, numerous brown birds (*Pupilo fuscus crissalis*) and valley quails (*Callipepla californica*) scurried from our path and hid themselves in the sage-bush chaparral which there abounds; and an occasional burrowing owl (*Speotyto cunicularia hypogæa*) would salute us with a school-boy bow as we passed. Where the cañon opens into the valley are many large spreading live oaks which, with their dark-green foliage and spreading form, resemble large apple-trees. Many of them have beautifully rounded tops, whose bases are only a few feet from the ground, and whose small dark-green leaves are so thickly set that it is impossible to see among the branches except from below. Farther up the cañon are a number of cottonwoods and a few willows, and still farther more oaks and several sycamores.

He who has collected only here in the East hardly knows how rich may be the results of a day spent in such a cañon as this. Here every tree could be climbed with no great difficulty, and anything it might contain was nearly always obtainable. When we reached the sycamores and cottonwoods the hooded and Bullock's orioles, happiest of all the cañon's happy birds, flitted among the green leaves, delighting the eye with their royal dress, and the ear with their rich melody of song. And a pair of magpies flew up from the edge of a little stream where they had come to make their morning toilet, and perched upon a cottonwood near by. Emphasis was given to their scoldings by excited jerkings of the tail and body after the manner of the jay. But as we had decided to begin collecting at the upper end of the coñon, we passed on without disturbing the nest which we plainly saw in the tree's top. As we neared the upper end of the cañon a California vulture (*Pseudogryphus californianus*) rose from the ground in front of us, where lay a dead pig upon which it was feasting, and soared away to the higher mountains. I know of no bird of more majestic flight than this great vulture of our

Western coast. While rising from the ground his movements are anything but graceful; he starts with a few very awkward steps and still more awkward flaps of his immense wings, but after reaching an elevation of fifty to seventy-five feet, flapping of the wings ceases, and as he circles above you, ascending higher and higher on motionless wings, he proves himself king of the soaring birds. But the magpie was the object of our trip, and to her we must return. Our time was well selected, for the nesting was at its height. The large globular nests were seen in the tops of a number of trees, and most of those that we climbed to contained good sets of eggs. We obtained nine sets altogether. Five nests were found in sycamores and contained three, six, seven, seven and nine eggs respectively. The full nest complement for each of the first two sets had evidently not been reached, as the eggs were perfectly fresh. Incubation had scarcely begun in the two sets of seven each; and the nine eggs of the other set showed but slight embryonic changes.

Two sets of eight eggs each were taken from nests in live oaks, and with these incubation had proceeded several days. One beautiful set of eight eggs was found in a nest in the top of a willow near the lower end of the cañon. In only two or three of the eggs were embryonic changes visible. But one nest was found in a cottonwood, the one we had "spotted" in the morning, and but a short distance from the willow just mentioned. In this nest we found four fresh eggs. Thus from the nine nests we got sixty eggs, which we regarded as a pretty fair day's collecting. From the above facts it seems safe to conclude that the usual nest complement of the yellow-billed magpie is from seven to nine eggs, and that the sycamore is the favorite tree in which to nest in that region.

The nest is a large globular structure very much resembling two crow's nests placed with their faces or edges together, the dome or roof of the nest being somewhat thinner than the lower part. An irregular-shaped entrance-way is left at one side, and the walls of the nest support the dome-shaped roof at a sufficient height to permit the long tail of the sitting bird to extend upward, as the horizontal diameter is not sufficient to permit any other disposition of that member. Except in the lining, very coarse material is used in the construction of the nest—large twigs of cottonwood being most frequently used. The nest is roughly

lined with finer twigs and strips of the inner bark of the cottonwood. A few of the nests we examined were newly made, but the majority were old nests which had been used in previous years. Quite a number of old deserted nests were found, particularly in the live oaks near this mouth of the cañon, where we found no recent nests at all. But a few years before a schoolhouse had been built near this grove of oaks, and the "small boy" proved too much for even the magpies, who retreated up the cañon, leaving their tents behind them.

The eggs of the yellow-bill magpie vary considerably in color as well as in size and general shape. The description of the color given in Baird, Brewer and Ridgway, and copied by Mr. Oliver Davie in his "Egg Check-list of North American Birds," is applicable to nearly all the specimens I have seen, viz., "The ground-color is a light drab, so clearly marked with fine cloudings of an obscure lavender color as nearly to conceal the ground, and to give the egg the appearance of an almost violet-brown." One set of four in my collection has the lavender very pronounced, and in quite large spots or blotches, rather most numerous about the larger end. The eggs of this set measure 1.35 × .95, 1.43 × .90, 1.29 × .90 and 1.33 × .94—the average 1.35 × .89, being the largest of any of the sets I have seen. Another set of eight gives 1.18 × .85 as the smallest, 1.40 × .85 as the largest, and 1.30 × .85 as the average. The average of a set of six given by Mr. Davie is 1.30 × .89, and on another page he gives 1.20 × .92, presumably the average of many sets. B. B. & R. give 1.20 × .90 as the measurement of an egg from Monterey, Cal. These last measurements seem rather under the average of those I have seen.

Several of the nests to which we climbed were old deserted ones, and contained no eggs. Mr. Corey, after much difficulty, reached one in which he was surprised to find a set of eggs of the sparrow-hawk (*Tinnunculus sparverius*).

While we had been quite successful in securing many good sets of beautiful eggs, these material things alone did not represent the profits which the day had brought to us. During our morning ride, besides the objects already mentioned, we had seen, enjoyed and conversed about a score of other things no less attractive. And now in the evening, as the sun sank beyond the hills, and the highest peaks of the cañon's walls received its last warm

glows ere it passed beyond the Pacific, new charms were added to the place. We saw the beautiful crested valley quails fly on whirring wing from the mesas and the chaparral to the dense foliage of the live oak, where their leader called to the night's repose; we heard the long-continued ringing note of the ground tit (*Chamæa fasciata*) from the thicket by the road-side; we heard —almost *felt*—the dismal, multitudinous barkings and howlings of a coyote that watched us from a ridge not far away, and could hardly believe one poor beast could carry on such a concert; we saw and heard and felt a hundred beauties which delight the soul and fill it with happy memories. We enjoyed most the fish we didn't catch.

——:o:——

THE PHYLOGENY OF THE CAMELIDÆ.

BY E. D. COPE.

AS is well known, the camels form a well-distinguished division of the Artiodactyla, or even-toed ungulates. The prominent features which separate them, osteologically speaking, from other Artiodactyla are three, viz., the absence of a canal of the cervical vertebræ which in other Mammalia encloses the vertebral artery (Fig. 1); the presence of an incisor tooth on each side of the

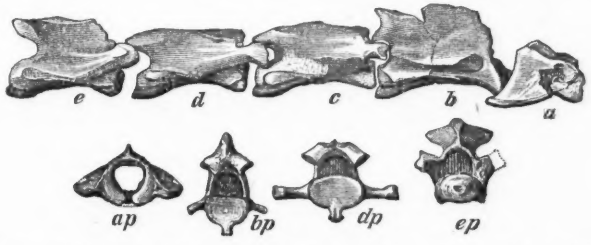


FIG. 1.—*Poëbrotherium labiatum* Cope; five anterior cervical vertebræ, showing absence of vertebrarterial canal; one-half natural size. Figs. *p*, posterior views of vertebræ lettered to correspond with those represented above them. Original, from specimen from White River bed of Colorado, represented in Fig. 7.

upper jaw (Fig. 12); and thirdly, the incompleteness of the keels of the distal ends of the metapodial bones (Fig. 2). This character and that of the presence of incisors, are primitive conditions common to all the early Mammalia. The peculiar cervical vertebræ constitute a specialization, but whether degenerative or pro-

gressive remains to be ascertained. In one respect this line exhibits a high specialization, which is present at the earliest known period of its history. This consists in the reduction of the lateral (II and V) metapodial bones, so that but two functional toes remain (see Fig. 1, *c–f*). This condition has been reached by the more typical artiodactyles after a much longer lapse of time, for most of the extinct and recent types display lateral digits in a well-developed or rudimentary condition; in but few of them have they totally disappeared. In another respect the line of the camels attains a higher specialization than that of the typical ruminants, although its beginning is that which is common to the entire suborder. This is in the dentition. The reduction in numbers of teeth showed by Owen to characterize the historical succession of all Mammalia, is carried further in the molar series of camels than in any hoofed order; for in the final term or genus, Eschatius (Cope), there is but one premolar left in the upper jaw, and that is reduced to a simple cone. The true molars never reach the complexity of those of the other line, of the Bovidæ or oxen, nor do they become prismatic as in that family, but retain the short crown well distinguished from long roots, which belongs to all the earlier Mammalia.

The successional reduction in the numbers of premolar teeth in the family of the Camelidæ is shown in the following table.[1] There is seen in the genera Protauchenia and Palauchenia a tendency to an increase of complication of the fourth inferior premolar.

I. Premolar teeth $\frac{4}{4}$.
P-m. I separated by diastema ..... *Procamelus* Leidy.

II. Premolar teeth $\frac{4}{3}$.
P-m. II below wanting ..... *Pliauchenia* Cope.

III. Premolar teeth $\frac{3}{2}$.
Fourth inferior premolar triangular ..... *Camelus* Linn.
Fourth inferior premolar composed of two crescents, which enclose a lake (an inferior P-m. 3?) ..... *Palauchenia* Owen.
Fourth inferior premolar composed of two crescents, with two posterior tubercles behind them ..... *Protauchenia* Branco.

IV. Premolar teeth $\frac{2}{1}$.
Fourth premolar below triangular ..... *Auchenia* Illiger.

V. Premolar teeth $\frac{1}{1}$.
Fourth superior premolar composed of two crescents ..... *Holomeniscus* Cope.
Fourth superior premolar consisting of a simple cone ..... *Eschatius* Cope.

[1] From Proceedings Amer. Philosoph. Soc. 1884, p. 16.

The only genera which include existing species are Camelus and Auchenia, the camels and llamas respectively. It may be remarked that the latter genus, which is confined to the new world, is more specialized than Camelus, which is restricted to the old world.

FIG. 2. — Carpus, cannon bone and first phalanges of *Procamelus occidentalis* Leidy, from New Mexico, from individual Fig. 12; *a*, anterior, *b*, posterior views. Original, from Rept. U. S. G. G. Surv. W. of 100th mer., G. W. Wheeler.

Ancestral to the Camelidæ is the genus Protolabis Cope (Fig. 10), which agrees with Procamelus (Fig. 11), the earliest genus of that family in most respects, but differs decidedly in having a full set of superior incisor teeth. In this genus we reach the stage, in tracing back the ancestry of the camels, which we find represented by Oreodon in the series of the Chevrotains (Tragulidæ), or the Gelocus in the line of the cattle and deer. It is probable, though not certain, that in Protolabis the metapodial bones are combined into a cannon bone as in the Camelidæ. If so it differs materially from its predecessor, the genus Poëbrotherium, and must be regarded as the type of a special family, the Protolabididæ.

The Poëbrotheriidæ have their general characters like those of the Protolabididæ, but the metapodial bones are entirely distinct (Figs. 3, 7). The molar teeth are truly selenodont, and the crescents, as in the other families, are but four in number. The premolars are entirely different in form from the molars, and the last one in the upper jaw consists of but two crescents, as in ruminants generally.

The family which should be ancestral to the Poëbrotheriidæ is not certainly known. It should possess the foot-characters of the latter with quadritubercular inferior and superior molars. That is,

instead of four crescents, these teeth should possess four cones or tubercles perhaps more or less flattened. Such forms are already known as ancestral to some other Ruminantia, as for instance the genus Anthracotherium, where the external cones are flattened on the outer side, or Dichobune, where the cones are not flattened at all. In both of these genera there are five tubercles to the superior molars, and the lateral (II, V) digits are present. We possess some fragments, however, of a lost genus from the age of the Poëbrotherium (the White River Miocene, or Oligocene), which very probably represents the one which fills the interval. This has been named Stibarus (Cope), and it is only known from parts of lower jaws which contain premolar teeth. These have a great resemblance to the corresponding parts of an older genus of the same line, Pantolestes, from the Wasatch formation or Lower Eocene. It might be suspected that Stibarus is a member of the Pantolestidæ but for one fact. The superior molars of Pantolestes belong to the primitive type which has only three tubercles or cusps. No genus of ungulate mammals having this character is known to pass the bounds of the Eocene series of epochs in any country, and it is extremely improbable that Stibarus will prove to be an exception to this rule. I have very little doubt that the superior molars will be found to be quadritubercular, but it is impossible to be certain whether the tubercles are simple or crescentic. The resemblance of the premolars to those of Pantolestes leaves the probabilities in favor of their being simple. In this case Stibarus represents a family in the wide interval between the Pantolestidæ and the Poëbrotheriidæ.

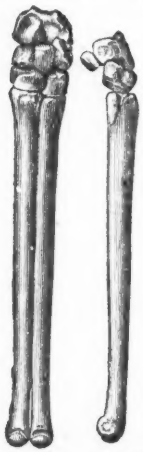


FIG. 3. — Carpus, metacarpus and end of cubitus of *Poëbrotherium vilsoni* Leidy. Original.

Messrs. Scott and Osborn have described a mammal, from the Bridger Eocene of Wyoming, as a probable member of the camel series, under the name of *Ithygrammodon cameloides*. It is only known from two premaxillary and a part of one maxillary bones. The former are slender and bear a complete set of incisor teeth, which are followed by a large canine. It is probable that this genus belongs in the camel series, but it cannot yet be positively affirmed.

The question of the origin of the Pantolestidæ is that of the origin of the suborder Artiodactyla. This I have believed would be found to have been from some yet undiscovered type or suborder of the order Amblypoda.[1] None of the known families of that order can have occupied this position, for although their general organization is appropriate, their superior and inferior molar teeth have been modified too much from the simple tritubercular type on which they are built. The ancestor of Pantolestes was an amblypod with the tubercles of its tritubercular superior molars entirely simple or conical. No such form has yet been discovered, but I have, in anticipation of such discovery, named the suborder the Hyodonta.

Dr. E. Schlosser in an abstract of an unpublished memoir to

Fig. 4.

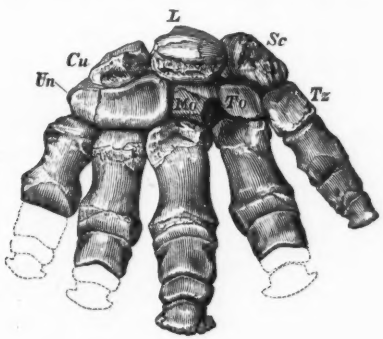


Fig. 5.

FIG. 4.—Left anterior foot of *Phenacodus primævus*, one-third natural size (original). FIG. 5.—Manus of Coryphodon (original). The cuneiform is imperfect. *Sc*, scaphoid; *L*, lunar; *Cu*, cuneiform; *Tz*, trapezium; *To*, trapezoides; *Mg*, magnum; *U*, uniform.

appear in the Morphologisches Jahrbuch,[2] takes the position that the Artiodactyla have been directly derived from the Taxeopoda and from the family of the Periptychidæ, thus leaving the Amblypoda out of their phylogeny. In this I cannot agree with him,[3] and for the following reasons:

The evolution of the Diplarthrous, or alternate wrist-and-ankle-boned Ungulata (Fig. 6), from the Taxeopoda, or straight-rowed wrist-and-ankle-boned Ungulata (Fig. 4), has been by the rotation

[1] Proceedings Amer. Philosoph. Society, 1882, p. 447. Report U. S. Geol. Survey Terrs., III, 1885, p. 382.

[2] Zoologischer Anzeiger, 1886, No. 222.

[3] On condition that the carpus of the Periptychidæ (which is unknown) is taxeopodous, as I have supposed.

inwards of the second row on the first, in both the fore and hind feet. This rotation has resulted sooner or later in the loss of the internal digit (thumb and great toe) from both extremities. In the history of this sliding inwards of the second row, the outside element of the row has always preceded in time the inside element. The Amblypoda (Fig. 5) show this clearly. The unciform bone has extended inwards so as to support the second bone of the first row (lunar) in part as well as the one which properly rests on it (cuneïform). But the magnum has not slipped inwards so as to support the scaphoid of the first row. That continues to be supported by its proper successors below, the trapezoïdes and the trapezium, the latter taking half the burthen. This structure (Fig. 5) is absolutely intermediate between that of the Taxeopoda (Fig. 4), and that of the Diplarthra (Fig. 6), and I imagine that all ungulates in passing from the taxeopodous to the diplarthrous stages traversed the amblypodous. The only other conceivable path would have been through a type in which the magnum had extended to below the scaphoid, while the unciform did not pass inwards beyond the limits of the cuneïform. No such type has been found. On the other hand, I have shown that the Oreodontidæ[1] have pushed the transposition of the bones of the second carpal row to such an extreme that the magnum has gotten entirely under the scaphoid, while the unciform supports the lunar completely. Thus the alternating position with its useful mechanical consequence has been lost to this group, the effect produced being exactly that seen in the Amblypoda. This may have had something to do with the extinction of the Oreodontidæ.

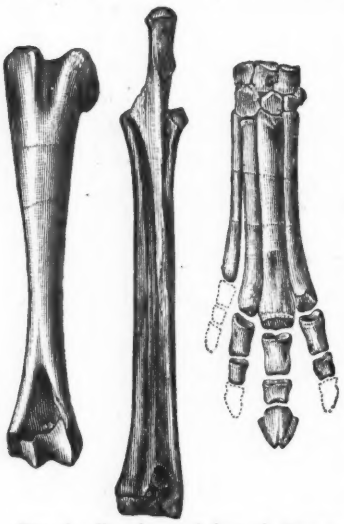


FIG. 6.—Fore-leg and foot of *Hyracotherium venticolum* Cope, two-thirds nat. size; from Eocene beds of Wind river, Wyoming. Original, from Report U. S. Geol. Surv. Terrs., III.

[1] Proceedings Amer. Philos. Soc. 1884, pp. 504-9, and 1884, p. 23 (Palæontolog. Bull., No. 39).

The following suggestions as to the origin of the three peculiarities of the cameloid series, or Tylopoda as they have been called, may be made. The imperfection of the distal metapodial keels (Figs. 2, 3 and 7) is probably due to the early development of an elastic pad of connective tissue beneath the proximal phalanges. It is this pad which gives the foot of the camel its peculiar lateral expansion, and causes its step to be both elastic and silent. This structure has relieved the metapodials of the concussions to which the feet of other Ruminantia are subject, and I have advanced this fact as the cause of the peculiarity of the metapodials above mentioned.[1] The cause of the absence of superior incisor teeth is unknown, but has been supposed to be complementary to the presence of horns in the Ruminantia. None of the camel line have horns, and the presence of the single incisor on each side may be connected with this fact; but why two of the incisors on each side should have been lost under the circumstances, is not explained. Nor has any explanation been offered for the absence of the vertebrarterial foramina of the cervical vertebræ (Fig. 1).

FIG. 7. — Hind foot of *Poëbrotherium labiatum* from specimen represented in Fig. 1. Original, from White River Miocene of Colorado.

There have been six species of the Pantolestidæ described, all belonging to the genus Pantolestes. The only ones of the six which are known from parts of the skeleton, are the *P. longicaudus* Cope, of the Bridger Eocene epoch, and the *P. brachystomus* of the Wasatch Eocene (Fig. 8). Neither of these species exceeded an existing musk-deer in size, and both had slender limbs. The tarsus of the *P. brachystomus* is known, and it is truly ruminant, though all the bones are distinct (Fig. 8). At the upper end the adjacent sides of the metatarsal bones are flattened and applied together, so that the later formation of a cannon bone by their fusion, must have been of easy accomplishment. The distal parts of these bones as seen in the *P. longicaudus* are not closely appressed, but are quite distinct from each other. The *P.*

[1] AMERICAN NATURALIST.

etsagicus, also from the Wasatch Eocene of the Big Horn river, is represented by a portion of a robust lower jaw as large as that of a fox.

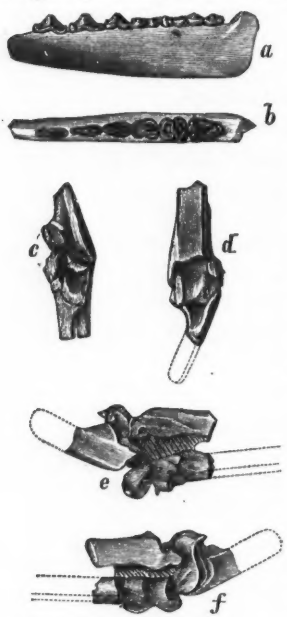


FIG. 8.—*Pantolestes brachystomus* Cope, nat. size, from Wasatch Eocene of Wyoming, Fig. *a*, superior molar teeth from below; *b*, mandible, left side; *c*, do. from above; *c*, tarsus with part of leg and metatarsus from before; *d*, from behind; *e*, from outside; *f*, from inside. Original, from Report U. S. Geol. Survey Terrs., Vol. III, F. V. Hayden.

But one species of Stibarus is known, and that from jaw fragments only in my museum and in that of Princeton College. These fragments appear to have belonged to an animal of the size of a pine weasel or martin, but the premolar teeth are very large for the size of the jaw and may indicate a larger animal. The anterior ones, ? first and second, have two roots each, and are quite elongate in the fore and aft direction. They are separated by a very narrow diastema from the tooth in front of them, ? the canine. The premolars are compressed and have a straight median cutting edge. This edge is thrown into two lobes between the anterior and posterior basal ones, the anterior only being the larger. The whole tooth resembles a rather low premolar tooth of a dog, and was evidently quite effective as a cutter of soft substances.

Of the Poëbrotheriidæ there are two genera. These differ as follows:

First premolar of upper jaw elongate and with two roots..... *Poëbrotherium* Leidy.
First upper premolar short and with a simple conic root..... *Gomphotherium* Cope.

In Poëbrotherium we have two species, a larger *P. labiatum* Cope, and a smaller *P. vilsoni* Leidy (Fig. 9). Both are animals of graceful and slender proportions, of about the size and build of the existing gazelles. Their heads were, however, of a more narrowed form towards the end of the muzzle. The remains of these animals have been found in the White River beds of Ne-

braska, Dakota, Wyoming and Colorado. They were evidently very abundant during Oligocene time.

The genus Gomphotherium embraces but one species, the *G.*

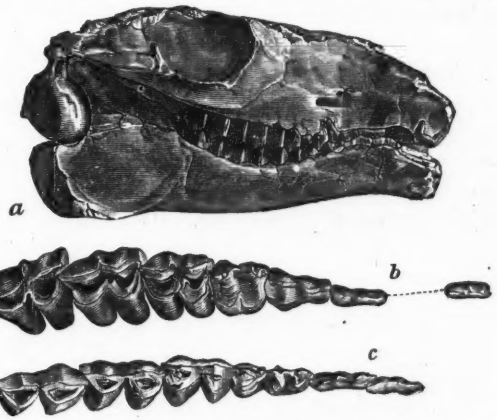


FIG. 9.—*Poëbrotherium vilsoni* Leidy, from White River Miocene of Nebraska. Fig. *a*, skull, right side, one-half natural size; *b*, superior molar teeth, nat. size; *c*, inferior molars, nat. size. From Leidy, Ancient Fauna of Nebraska.

sternbergi Cope, which was found by Mr. C. H. Sternberg in the John Day Miocene beds of Central Oregon. Its size exceeds that of either of the Poëbrotheria, equaling that of a llama.

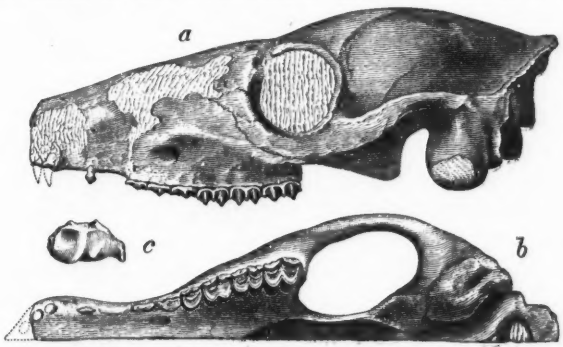


FIG. 10.—*Gomphotherium sternbergii* Cope, two-fifths nat. size, from the John Day Miocene of Oregon. Fig. *a*, left side; *b*, inferior side; *c*, distal end of radius. Original, from Report U. S. Geolog. Survey, F. V. Hayden.

Its limbs were also slender, and in their general characters resemble those of the genus which preceded it. The second and fifth digits are represented on both feet by small scale-like bones

adherent to the sides of the two median metapodials. The inferior premolars in this genus are all much compressed, but differ much in form from those of Stibarus. The first upper premolar is a simple tooth with a subconical crown, totally different from the long cutting crown of the corresponding tooth in Poëbrotherium. The next two premolars alone are compressed, though the third is rather wide posteriorly. The fourth is like that of other ruminants.

The oldest species of Protolabis, *P. transmontanus* Cope (Fig. 11), was obtained from the Ticholeptus beds, which overlie the John Day beds in Central Oregon. Its skull and a few bones

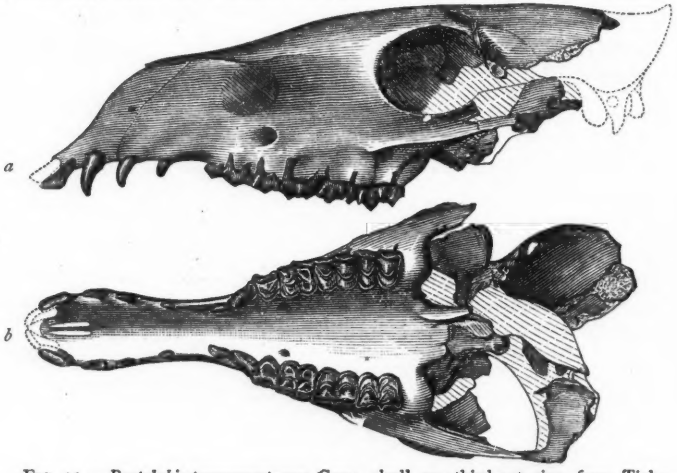


FIG. 11.—*Protolabis transmontanus* Cope, skull one-third nat. size, from Ticholeptus bed of Oregon. Fig. *a*, from left side; *b*, from below. Original.

only are known, but the former displays very complete dentition. Its size is about that of the Virginia deer. Its dimensions are in strict accord with the rate of increase of size to be observed in this series, and which it will be noticed, is maintained to the Pliocene epoch, when the greatest dimensions were attained. Two species of Protolabis appear in the succeeding or Loup Fork epoch which exceed the *P. transmontanus* in size. These are the *P. heterodontus* and the *P. prehensilis* Cope.

Accompanying the latter we have the species of Procamelus Leidy, the earliest members of the true Camelidæ. Its species vary in size from that of a sheep, as *P. gracilis* Leidy, to that of a deer, *P. occidentalis* Leidy, and to that of a camel, *P. robustus*

Leidy. The *P. occidentalis* (Fig. 12) appears to occur wherever the Loup Fork beds exist, from New Mexico north and east to Dakota. The *P. angustidens* Cope, intermediate in size between this form and the *P. robustus*, is not rare in Kansas and Colorado. Six or seven species of this genus have been named, one of them from teeth found near Richmond, Virginia. Species of the genus probably occur in beds of corresponding age in Florida.

Pliauchenia has been found as yet only in New Mexico, in two species not well preserved. It is not certain that any species of

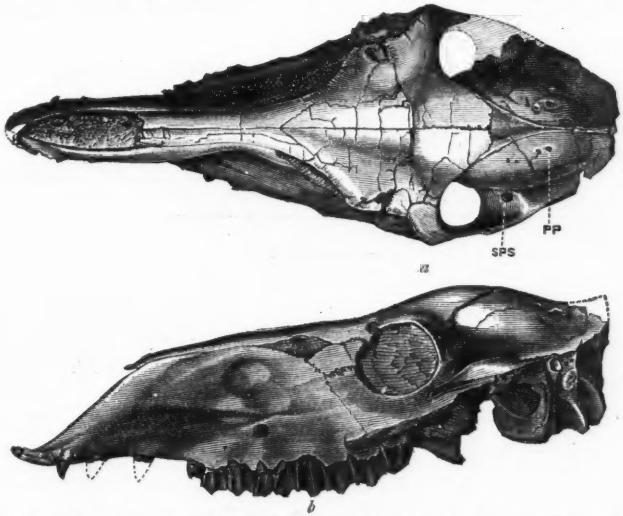


FIG. 12.—*Procamelus occidentalis* Leidy, one-third nat. size, from Loup Fork bed of New Mexico. Fig. *a*, skull from above; *b*, do. from left side. Original, from Report U. S. Expl. Surv. W, 100th mer., Vol. IV, G. M. Wheeler.

the genus Auchenia (llama) has been found fossil within the United States, though several have been described. Some or all of these belong to Holomeniscus Cope, which has only one premolar above, while Auchenia has two. A species about as large as a large llama has been found in the Oregon desert and named *H. vitakerianus* Cope. Another as large as the largest known camel is the *H. hesternus* Leidy. This fine species ranged from Oregon through California to the valley of Mexico, where it has been found by Professor Castillo of the School of Mines. A still larger species, perhaps of this genus, the *H. californicus* Leidy, must have exceeded in its dimensions either of the living camels. It is known from a few bones from California, and perhaps from Mexico.

The most specialized of all the genera of Camelidæ, Eschatius Cope, extended its range from Oregon to the valley of Mexico. I owe to the courtesy of my friend Dr. Mariano Barcena, formerly director of that department of the Museo National of the City of Mexico, the opportunity of inspecting specimens of the jaws and teeth of this genus. It is represented by two species. The larger, *E. conidens* Cope, was about as large as a camel or dromedary. It ranged from the valley of Mexico to Oregon; specimens found by Mr. Sternberg in the latter region not being distinguishable from those of the Mexican origin. The second species, *E. longirostris*, is a good deal smaller, and is only known from the same Equus beds of Oregon which have yielded the larger one.

The succession of structure in the leading genera of the selenodont or tylopod part of this phylogeny may be represented as follows:

	No cannon bone.			Cannon bone present.		
	Incisor teeth present.			Incisors one and two wanting.		
	4 premolars.			3 prem's.[1]	2 prem's.	1 prem'r.
Lower Miocene	*Poëbrotherium.*					
Upper Miocene		*Protolabis.*	*Procamelus.*	*Pliauchenia.*		
Pliocene and recent					*Camelus.*	*Auchenia.*

This table shows that geological time has witnessed, in the history of the Camelidæ, the consolidation of the bones of the feet and a great reduction in the numbers of the incisor and premolar teeth. The embryonic history of these parts is as follows: In the fœtal state all the Ruminantia (to which the camels belong) have the cannon bones divided as in Poëbrotherium; they exhibit also incisor teeth, as in that genus and Protolabis. Very young recent camels have the additional premolar of Pliauchenia. They shed this tooth at an early period, but very rarely a camel is found in which the tooth persists. The anterior premolar of the normal Camelus is in like manner found in the young llama (Auchenia), but is shed long before the animal attains maturity. I may add that in some species of Procamelus caducous scales of enamel and dentine in shallow cavities represent the incisive dentition of Protolabis.

FIG. 13.—Cast of brain of Poëbrotherium, one-half nat. size. From Bruce, in Bulletin of E. M. Museum, Princeton, N. J.

[1] In lower jaw.

In greater detail, the extinct American forms of this line are distributed as follows:

	Eocene.		Miocene.				Pliocene.
	Wasatch.	Bridger.	White River.	John Day.	Ticholeptus.	Loup Fork.	Equus.
Pantolestes Cope.....	5	1					
Ithygrammodon S. O..		1					
? Stibarus Cope.....			1				
Poëbrotherium Leidy.			2				
Gomphotherium Cope.				1			
Protolabis Cope.....					1	2	
Procamelus Leidy....						6	
Pliauchenia Cope.....						2	
Holmeniscus Cope...							3
Eschatius Cope.....							2

The total number of genera, nine; of species, twenty-six.

The development of the brain displays the same progress that has been shown by Lartet and Marsh to have taken place in other lines of Mammalia. The accompanying figures of the brain, show that while the *Procamelus occidentalis* is inferior to the camel in the size and development of the convolutions of the hemispheres, it is in advance of the *Poëbrotherium vilsoni* in these respects (Figs. 13–14).

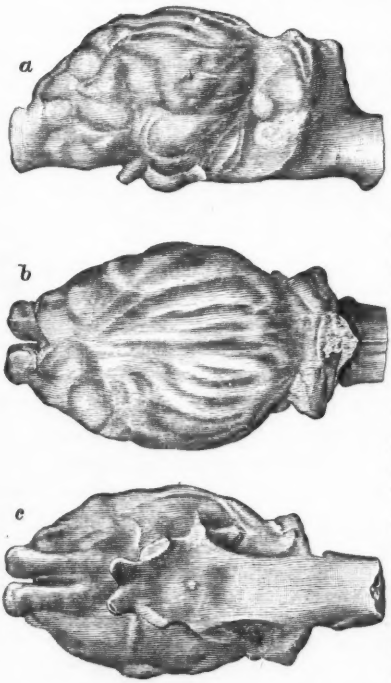


Fig. 14.—*Procamelus occidentalis*, cast of brain from skull represented in Fig. 12, one-half nat. size. Original, from Report U. S. G. G. Surv. W. of 100th mer., 1877, Vol. IV, G. M. Wheeler.

The development of the camels in North America presents a remarkable parallel to that of the horses. The ancestors of both lines appear together in the Wasatch or lowest Eocene, and the successive forms develop side by side in all the succeeding formations. Camels and horses are standard types in all our Tertiary formations; and they must be learned by

any one who wishes to distinguish readily the horizons one from the other. The horse-forms are more numerous in all the beds, in individuals as well as in species. Both lines died out in North America, and of the two, the camels only have certainly held their own in South America. The history of the succession of horses in Europe, although not as complete as that in America, extends over as wide a period of time. Not so with the camels. There is no evidence of the existence of the camel line in the old world prior to the late Miocene epoch; and so far as the existing evidence goes, the new world furnished the camel to the old.

Camelidæ only appear in South American palæontology in the genus Auchenia, in Pliocene time, in the Pampean beds. The best known species are *Auchenia weddellii* and *A. intermedia* of Gervais. It is curious that M. Ameghino, in his report on the fauna of the Miocene age found on the River Parana, which contains the ancestors of so many Pliocene genera, finds none that stand in that relation to these llamas.

——:o:——

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— Various suggestions have been made as to the permanent organization of science at the National Capital. The necessity for the employment of experts having been felt in various departments of the Government, commissions and offices for the conduct of research have grown up in them. The results have been greatly to the advantage of the Government and of the people, and have often represented important advances of science itself. The efficiency of these commissions has, however, often been impaired through their association with the various bureaus and departments under which they are placed. This comes from their necessary direction by non-experts and the quantity of routine work which may be required of them. There is also necessarily more or less overlapping of the similar offices in the different departments. Many of the commissions have been from time to time threatened with total extinction through the want of knowledge of their utility by some of our legislators. Several illustrations of this fact have recently occurred in Washington. The able superintendent of the Coast Survey has been removed, and his place taken by superior clerk of the Treasury Department.

A bill has been introduced into the House of Representatives by Mr. Herbert, of Alabama, which forbids the publication of its results by the Geological Survey, which, with other restrictions, is almost equivalent to its abolition.

On the other hand a bill has been introduced by Mr. Reagan, of Texas, creating a "Department of Industries," to be represented in the Cabinet. This bill contemplates combining in the new department the following divisions: Agriculture, Labor and Commerce. The division Agriculture embraces the subdivisions: 1. Agricultural products, including botany, entomology and chemistry; 2. Animal industry; 3. Lands, including the geological survey.

As regards the intrinsic merits of this proposed new department we have nothing to say, but we think there are better ways of disposing of the scientific work of the Government. The above plan omits necessarily a number of important scientific bureaus, and does not provide for the consolidation of all the offices which pursue a given branch of science. Thus there will be a chemical commission in the Agricultural Department and another in connection with the Navy, as at present, and so on.

If it can be done properly, the creation of an organization to be called the Department or Bureau of Science and Public Instruction, to be embraced in the present Department of the Interior, might meet the necessities of the case. Such a department would embrace the present Naval Observatory, Nautical Almanac, Signal Service, Coast Survey, Fish Commission, Geological Survey, Agricultural Department, Bureau of Statistics and Bureau of Education. The diverse and heterogeneous character of the above divisions might be remedied by a suitable re classification.

Each of the divisions should be under a capable expert, who should devote his time to promoting the efficiency of the work. Financial matters to be under direct management and control of the head of the entire bureau.

But the essential to success of this or of any other plan for promoting science at Washington is that its offices be removed from the field of political patronage. How this is to be done is the question. The Smithsonian Institution as a private corporation, and the National Museum as under its direction, are happily removed from such contingency, and any system which would place the scientific commissions and bureaus in a position of equal security, would be a great benefit to them. Nothing would be gained in this direction by the creation of the proposed new department. For this reason the commission appointed by Congress to investigate the relations of the scientific bureaus to each other and to the Government has decided that no change of organization should be made at present.

RECENT LITERATURE.

GILBERT'S TOPOGRAPHIC FEATURES OF LAKE SHORES.—This treatise is reprinted from the fifth annual report of the director of the U. S. Geological Survey, and is based on the observations of many years, particularly in Utah, around the shores of Great Salt lake. The author states that the body of the essay was prepared before he met with the writings of Elie de Beaumont and of Cialdi. It is well illustrated with original diagrams and land-

FIG. 1.—Sheep Rock, a sea-cliff on the shore of Great Salt Lake, near the Black Rock bathing resort.

scape illustrations, some of which we have been permitted to use.

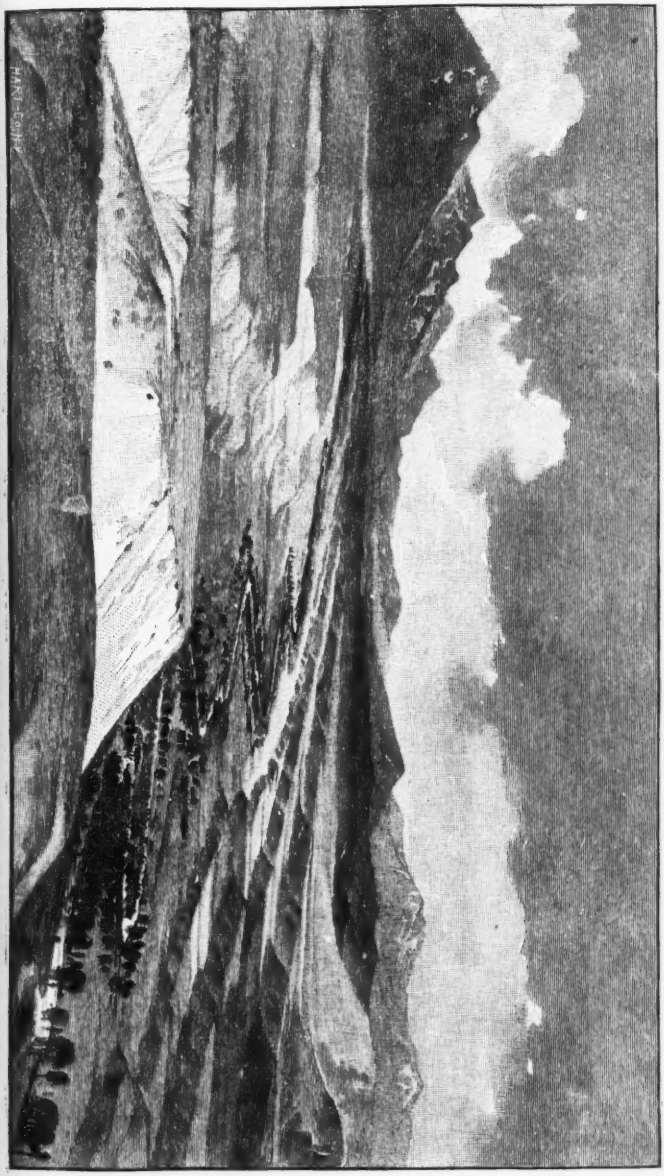
After discussing the subject of earth-shaping, a second section treats of littoral erosion. While the impact of large waves has great force and its statement in tons to the square foot is most impressive, the author believes, as the result of his own observations, that "the erosive action of waves of clear water beating upon firm rock is practically nil. It rarely happens, however,

PLATE XXV.

Ancient Sea-cliff in boulder clay, South Manitou Island, Lake Michigan.

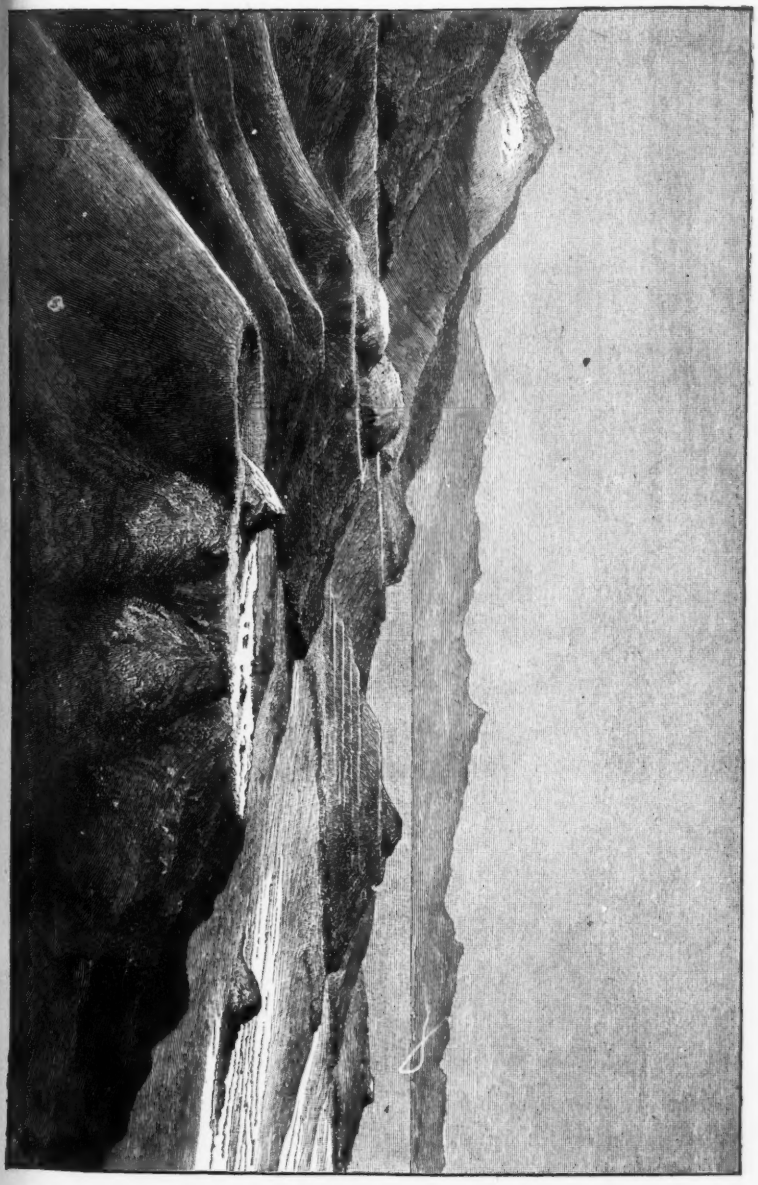
Bird's-eye view of Madison Valley, Montana, showing stream terraces.

PLATE XXVI.



Bird's-eye view of Madison Valley, Montana, showing stream terraces.

Cup Butte, a vestige of the Bonneville shore-line.



Cup Butte, a vestige of the Bonneville shore-line.

that the impact of waves is not reinforced by the impact of mineral matter borne by them. The detritus worn from the shore is, of course, always at hand to be used by the waves in continuance of the attack; and to this is added other detritus carried along the shore."

The sea cliff and wave-cut terrace are then described and well illustrated; then follow the discussion of littoral transportation, the beach and the barrier. Under the last head the following remarks on the part played by great floods and storms will interest our readers:

"Not only is it true that the work accomplished in a few days

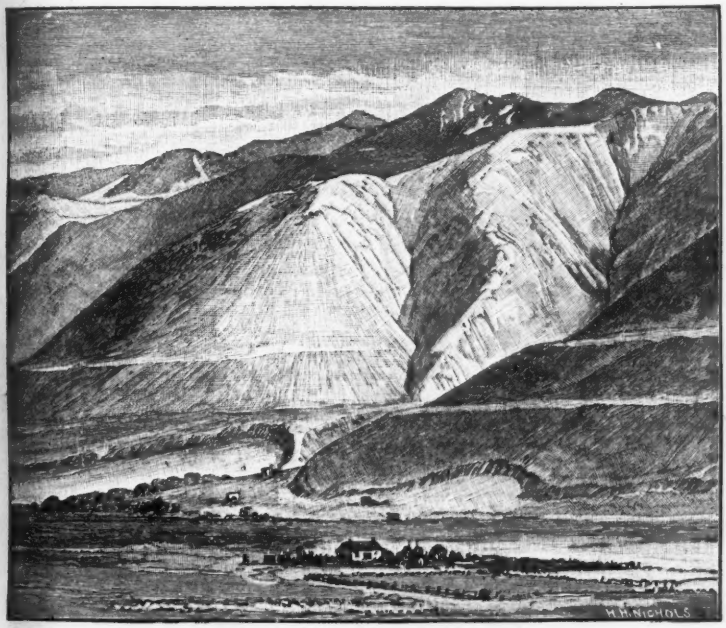


FIG. 2.—Fault scarps and shore lines at the base of the Wasatch.

during the height of the chief flood of the year is greater than all that is accomplished during the remainder of the year, but it may even be true that the effect of the maximum flood of the decade or generation or century surpasses the combined effects of all minor floods. It follows that the dimensions of the channel are established by the great flood and adjusted to its needs.

"In littoral transportation the great storm bears the same relation to the minor storm and to the fair-weather breeze. The waves created by the great storm not only lift more detritus from

each unit of the littoral zone, but they act upon a broader zone and they are competent to move larger masses."

Under the head of littoral deposition the origin of embankments, spits, bars, hooks, loops, wave-built terraces, V-terraces, V-bars and of dunes is discussed.

The third section is devoted to the distribution of wave-wrought shore features; a fourth section to stream work and deltas. In a fifth section ice work and shore walls on lakes are described. After referring briefly in section six to the effects of submergence and emergence on the phenomena under consideration, attention is called in the seventh section to the discrimination of shore features, under the head of cliffs, fault scarps, terraces, fault terraces, etc., and ridges, the latter being contrasted with moraines and osars. Fig. 2 gives a good idea of the remarkable fault-scarps at Farmington, Utah. The eighth and last section relates to the recognition of ancient shores.

The essay is upon a subject of very general interest, every geologist having his attention drawn to the phenomena which the author explains. A similar work based on sea-shores would be of still wider interest and importance, though some attention is given to the subject in our leading text-books on geology.

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——Ditto ditto from the Amer. Jour. Science.

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Lydekker, R.—Catalogue of the fossil Mammalia in the British Museum. Part II. Ungulata Artiodactyla. London, 1885.

——On the occurrence of the crocodilian genus Tomistoma in theMiocene of Malta.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*Tong-king.*—The April number of the Proceedings of the Royal Geographical Society contains a map of Tong-king, accompanied by an article upon the hill region which lies beyond the delta of the Song-coi. The writer (Mr. I. G. Scott) states that though the Song-coi is a noble-looking river, boats drawing over fifteen feet cannot ascend its Cua Cam mouth to Haiphong, while boats drawing six feet have difficulty in reaching Ha-noi. There are four principal mouths, of which the Cua Cam is the most northern, but it seems probable that the Cua Dai (the most southern) will shortly be made use of for deep-sea ships. The provinces of Kwung-yen, Lang-son, Cao-bang, Thai-nguyen and Tuyen-kwan form the plateau region, north of the Song-coi delta. This is a land of rounded, grassy hills, without prominent peaks.

The delta is rapidly extending. When Ha-noi was built by the Chinese in the eighth century, it was a sea-port, but is now a hundred miles inland. Two centuries ago Hung-yen was on the coast, and was the site of the Dutch and Portuguese factories. It is now thirty miles inland. Our author declares that Lang-son is, geographically and ethnographically, Chinese. It is on the Chinese slope and is separated from the rest of Tong-king by a barren mountain belt fifty miles in width. Some remarkable cave-temples exist near the town.

The Survey of Japan.—During the last five years the National Survey of Japan has been steadily progressing under the superintendence of Dr. Naumann, who has now left the task to be carried out by the Japanese he has trained. An account of the work performed may be found in *Nature* (April 29th, 1886). The survey was based mainly on economical considerations, and started with topographical, geological and agronomical departments. A chemical section was added. The existence of Devonian, Carboniferous, Triassic, Jurassic, Cretaceous and Tertiary rocks was

[1] This department is edited by W. N. LOGKINGTON, Philadelphia.

proved by well-characterized fossils. Radiolarian slates, probably older than the Carboniferous limestone, occur in almost every part of the archipelago. The Japanese island chain is one of the finest examples of a mountain range of unilateral structure.

Asiatic News.—The Russian Trans-Caspian railway was by the end of last year opened as far as Ghiaurs. From this spot to Merv the necessary earthworks were completed. From thence to Chardjui, 118 miles from Merv, the route will be across desert. It is proposed to prevent the access of moving sand by plantations along the line.——An ethnographical map of Asia, six and a half feet by four and a half feet, showing the localities of 136 divisions of peoples and languages, in twenty-six tints of color and shading, has been made by Herr Vincent von Haardt, of Vienna.——A recent issue of *China Review* contains an article, by Mr. C. Taylor, upon the aborigines of Formosa. Mr. Taylor has resided four years in the south of the island, and his information regarding the Paiwans, or people of this part, is therefore derived from intimate observation. He is also acquainted with the Ameirs, who have scattered themselves in small villages along the east coast down to South Cape. With the Pipohuans, or half-castes of the plains, and the Tipuns, he is only acquainted through information obtained from stragglers domiciled among the Paiwans. ——The report of Mr. G. Schumacher, published by the Committee of the Palestine Exploration Fund, is full of interesting details upon the Jaulan and Hauran regions. The river Yarmuk, whose course marks the southern limit of the Jaulan basaltic region, receives from the north several tributaries, which are here for the first time correctly mapped. The Rukhad, one of these, rises at the foot of Mt. Hermon (Jebel-esh-Sheikh). Its tributary, the Wady Seisun, falls 517 feet in 420 yards by a succession of cataracts. These rivers have their sources in springs, and there are clear indications of the existence of large reservoirs of underground water in the basaltic and calcareous formations.

Asiatic Islands and Australia, etc.—Barren and Narcoudam, two volcanic islands belonging to the Andaman archipelago, and lying east of the main islands, have been surveyed by Capt. Holday, of the Indian Survey. Barren island is circular, about two miles across, and its principal features are a main crater, with axes of one and a half miles and one mile, and an inner cone about half a mile across at its base and rising 1015 feet above the sea. The inner cone bears upon its summit a small crater from which steam and smoke issue. The volcano is known to have been active towards the end of last century.

Narcoudam is about two and a half miles in length and half as broad. It rises 2330 feet above the sea, and is composed of trachytic lava, but no trace of any crater was discovered. The slopes are covered with dense forest, but no water was found.

Mr. E. W. Birch has recently visited and reported upon the Keeling or Cocos islands. These islands, over twenty in number, very narrow and thickly planted with cocoa palms, surround a lagoon for the most part shallow. The island is evidently rising. The islands are administered by an English family named Ross, and have a Malay population of more than 500. The temperature is wonderfully equable, varying in a year only from 72° in September to 84° in April.

Mr. Winnecke asserts, as in 1877, that Lake Eyre is a considerable depth below sea-level. The highest point along his survey of the route of the overland telegraph was the Burt plains, 2532 feet above sea-level; but the MacDonnell ranges, in which these plains are situated, rise several thousand feet higher. The Finke river, the southern part of which is now being reëxplored by Mr. Lindsay, is described as the largest and most important in Central Australia.

The population of the Sandwich islands has increased from 57,985 in 1878 to 80,578 in 1884, yet in that time the native race has diminished from 44,088 to 40,014. The census of 1884 gave 17,932 Chinese, 9377 Portuguese, 2066 Americans, 1282 British, and 1600 Germans; the previous numbers (1878) being 5916, 436, 1276, 883 and 272 respectively.

A new atlas of the Dutch East Indies has been published at the Hague. It contains a map of the entire archipelago, four maps of Java and Madura, giving population, roads, etc.; maps of parts of Java to a still larger scale, and others of Banka, Billiton, Borneo, Celebes, Sumbawa, Timor, the Moluccas, etc.

EUROPE.—*European News.*—From the observations of E. von Meydell, extending over a period of eight to ten years, it appears that the waters of the Black sea are subject to slight variations of level dependent upon the amount of water brought down by the Danube, Don, etc. The maximum, nine to seventeen centimeters above mean water-level, is attained in May and June, and is highest in those years in which the rainfall in Central and Southern Russia is greatest.——New and more precise levelings to ascertain the heights above the sea of Lakes Ladoga, Onega and Ilmen (Russia) place them at 16, 115 and 59 feet respectively; instead of, as before believed, 59, 237 and 157 feet.——The population of Prussia (not the German Empire), according to the census of December 1, 1885, was 28,314,032. In 1880 it was 27,279,111.—— "The highest peak in Denmark" is a hill in the forest of Ky, 163 meters in height.

AMERICA.—*American News.*—A Swiss named Rodt has founded a flourishing colony in Juan Fernandez, which he leases from Chili. Not only agriculture, but manufacturing industries are practiced. The colonists comprise members of most civilized nationalities, except Prussians, who are excluded.——In the Jan-

uary issue of the *Revue Geographique*, M. H. Condreau gives an account of the manners of the Uapes. Most of the tribes of the river border have no garment whatever, but in some tribes the men wear a "calembe" of bark, and in the villages lower down the river the men don pantaloons and the women a chemise when they are full-dressed. Some tribes still inter their dead in the "maloca," or hut, which the Tucanas immediately abandon in order to build another.——M. Thouar reports as the result of his last journey to the rapids of the Pilcomayo, that it is possible at any season of the year to go from the mouth of that river at Lamboné to the mission of San Francisco de Solano, in Bolivia, at the very foot of the Andes. The difficulties caused by accumulations of trees and the consequent formation of shallows can, he believes, be overcome.

AFRICA.—*African News.*—The missionaries sent out by the Basel Missionary Society to the Gold coast have, since 1882, explored the Volta basin pretty thoroughly, and the geographical results obtained have been considerable. A map of the routes is published in the April number of the Proc. Roy. Geog. Society. ——Lieutenants Kund and Tappenbeck struck southward from Stanley pool in August last, returning to Leopoldville on January 27th. They crossed the Quango, also the Bolombo or Sankuru and its affluents, and descended the Lukenje to Kwamouth. It is stated that they have discovered a new river, the Ikata, which M. Wauters believes to be the upper course of the Mfini.——The Bulletin of the Soc. Roy. de Geog. d'Anvers contains an interesting account of an exploration upon the Senegal, from Futa-Djallon to Bambouc, undertaken by M. E. Noirot, who seems everywhere to have met with a good reception, and who is enthusiastic respecting the productions and future commerce of the Senegal basin.——The murder of the young and enterprising French traveler, Palat, at two days' distance from Insalah, is alleged to be due to the Senonsian fraternity. On the other hand, French journals are disposed to lay much of the blame upon the French commandant, whose treatment of the adventurous young lieutenant was such as to make the Arabs believe him to be in disfavor with his own people.——The members of an expedition sent out by the Geographical Society of Milan have been massacred by the Emir of Harrar. Count Porro, the leader, Professor Sicata, and seven others were killed.——M. Barral and his wife, who set out from Obock to explore Abyssinia, with the object of establishing commercial relations, were murdered by the Danakils on the borders of Shoa.——Mr. R. Baron communicates to *Nature* some valuable notes upon the volcanic phenomena of Central Madagascar. In this part there are many extinct volcanic cones, especially in two localities situated, the one fifty to sixty miles west, the other seventy to eighty miles southwest of Antananarivo.

They are scoria cones, none of them probably rising more than 1000 feet above their base. Many have breached craters, whence floods of black basaltic lava have flowed. The almost perfect state of preservation of the cones and the undecomposed condition of the lava proves that these volcanoes must have been active in comparatively recent times.——Scarcely a year passes without one or more earthquake shocks in Central Madagascar, but they are never severe nor of long duration.——Cardinal Massaja has published at Rome a work entitled "My thirty-five mission years in Upper Ethiopia." Numerous illustrations and a good map accompany the text.

GEOLOGY AND PALÆONTOLOGY.

THE FOSSIL MAN OF PEÑON, MEXICO.—On my return to this city after a long absence, I read the observations published in the *New York Tribune* concerning my account of the fossil man of the Peñon.

It will give me great pleasure to clear up the doubt expressed by Professor Newberry with regard to the importance of the discovery of the man of the Peñon.

Professor Newberry does not believe in the importance of the discovery, and argues in this manner: "The calcareous bed in which the fossil remains were found must have been modern travertin; it could not have been deposited below the waters of a lake, but probably belongs to an aërial or superficial formation, since otherwise it would be of equal thickness and uniform on the bottom and on the borders of the lake; if the limestone is siliceous, it must belong to a hydrothermal deposit."

It is above all certain that the limestone is not modern travertin, for it does not form concentric layers above the human remains, nor over other recent objects, as would be the case were it such. The bones are sealed up, so to speak, in the calcareous rock, without being in any way coated, and were probably deposited while the rock was yet soft and under water. As the clearances and excavations at the foot of the small mountain of Peñon have been continued, I have been able to prove the persistence of the facts indicated in my article published in the NATURALIST, August, 1885, as well as in a fuller account of the same subject published in 1884 by Professor Antonio del Castillo and by me.

The new excavations have shown more clearly yet the three formations of which I have spoken, ranged as follows:

(1) A superficial layer 10 centimeters thick, formed of vegetable earth, containing lacustrine shells and fragments of modern pottery.

(2) A layer of calcareo-siliceous tufa, of but slight hardness, with remains of old pottery, 50 centimeters thick.

(3) Siliceous limestone, very hard, in a thick bed, inclined towards the north. Here are found roots transformed into *men-*

ilite and lacustrine shells. It is in this bed that human remains, and no others, have been found. The thickness of this bed is not yet known, as it has only been opened to a depth of 1.2^{m}. The bed is covered by a thin layer of a limestone richer in quartz, a true ribbon, dividing the adjacent formations.

Not a single modern object has been found in this bed, nor in another similar one situated to the south of the mountain, more than a meter thick, and resting on a lacustrine and turfy formation.

Two miles northwest of Peñon there is another bed of siliceous limestone at the foot of the mountain chain of Guadalupe, and stretching over a great length. This limestone is in composition, appearance and position, identical with that of Peñon, containing roots transformed into menillite, and in its upper part fragments of old pottery. What is most important in this formation *is the existence of elephant bones sealed in the hardest bed, like that of Peñon.* These bones have been taken out on many occasions. I have done it myself in the presence of the professors of the National Museum.

The distance from this bed to that of Peñon is so inconsiderable, and the circumstances and physical character are so similar, that this bed and that of Peñon can be considered as belonging to the same geological horizon, so long as no object indicating a different horizon is found in the latter. Meanwhile all our observations induce us to believe in the contemporaneity of the man of Peñon and of the mammoth in the valley of Mexico.

I must now show why, according to my belief, the limestone of Peñon was once engulfed below the waters of the lake. In the first place, it is evident that the bed has been raised and tilted, so as to occupy a position different from its primitive one, and, the Peñon having for an enormous number of years been surrounded by water, we must believe that the calcareous bed, which is now three meters above the level of the lake, was covered with water during the same interval. Besides, it contains the shells of Paludina and other aquatic species, and this dissipates all remaining doubt of its former position beneath the waters of the lake.

Professor Newberry is correct in remarking that it is very rarely that lime, which in the first instance is dissolved in water in the state of carbonate, is not precipitated so as to form a uniform bed over the bottom of the lake. This is the ordinary case, and what might be expected; but the deposit has only been observed in isolated masses, and the peculiarity can be explained by supposing that the bed has been buried deeply below its actual surface and covered by the modern deposits of the lake in many places, though this cannot yet be stated as a proved fact. The hydrothermal origin, which I have attributed to the limestone in the article in the NATURALIST, has been proved by later observations, for in many fissures of the Peñon rock thin veins are found composed of calcareous matter in some cases, of siliceous in others. Besides,

upon the summit of the Guadalupe mountains occur masses of shell-rock (*masses lavignes*) impregnated with siliceous limestone, which demonstrates their contemporary origin. What hinders me from believing that the existing hydrothermal springs at the foot of the Peñon can be the origin of the formation which surrounds the mountain is that these springs form only isolated and insignificant deposits, which cannot spread out uniformly like the limestone beds; at most they could form accumulations like those of which Professor Newberry speaks, and which are characteristic of geysers. The above-mentioned springs were probably the last traces of the abundant eruptions of calcareo-siliceous waters which formerly shot forth at the same time with lava, as at Peñon and at many other points in the valley of Mexico. The superficial revetements are caused by the solution and precipitation of the materials which cover the upper rocks, of the veins, or of the alteration of the basalts of the mountain. We must, therefore, believe in the importance of the discovery of the man of the Peñon.

No one can be more anxious than I to base these discoveries upon clear and well-determined facts, as I stated in my article in the NATURALIST. Professor Castillo and myself have assiduously studied the Peñon formations, and with the sincerity which scientific truth exacts we will inform the learned world of later discoveries. If it should happen that in the rocky tomb of the man of the Peñon the remains of his primitive weapons or the iron of his conqueror should be found, we shall doubtless be the first to announce it.—*Mariano Barcena.*

ON THE FOSSIL FLORA OF THE LARAMIE SERIES OF WESTERN CANADA.[1]—The Laramie series, formerly known as the Lignite Tertiary or Lignitic group, occurs in Canada, principally in two large areas west of the 100th meridian and east of the Rocky mountains, and stretching northward from the United States boundary. These areas are separated from each other by a low anticlinal of Cretaceous beds, over which the Laramie may have extended previously to the later denudation of the region.

These areas may be designated—(1) The Eastern or Souris River and Wood Mountain area; (2) the Western area, extending along the eastern side of the Rocky mountains and across the upper waters of the Bow, Red Deer, Battle and North Saskatchewan rivers.

In the southern part of the district of Alberta it has been found possible to divide the Laramie into three parts, which have been named respectively, in the Reports of the Geological Survey of Canada, (1) the lower or St. Mary River division, (2) the middle or Willow Creek division, and (3) the upper or Porcupine

1 Abstract of a paper read before the Royal Society of Canada, May, 1886, by Sir William Dawson, LL.D., F.R.S.

Hill division. Of these the lower and upper contain fossil plants, more especially the latter, and corresponding horizons can be recognized by these in both of the great areas above referred to. The flora of the lower division has a close alliance with that of the Belly River group of the underlying Cretaceous, while that of the upper division is in the main identical with that of the Fort Union group of the United States geologists, as described by Newberry and Lesquereux.

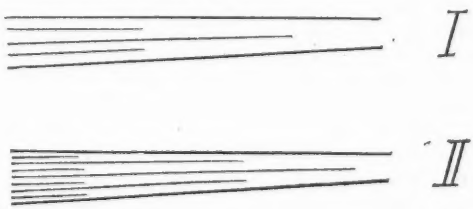
In the Eastern area the lower beds of the Laramie rest on the Fox Hill group of the Cretaceous, and are in turn unconformably overlaid in the Cypress hills by beds referred, by Professor Cope on the evidence of mammalian remains, to the White River division of the Miocene Tertiary. Thus the geological horizon of the Laramie is fixed by its stratigraphical relations as between the Upper Cretaceous and Lower Miocene formations. The evidence of fossil remains accords with this position. The Lower Laramie has afforded reptilian remains of Mesozoic aspect, associated with fishes and mollusks, some of which are of Eocene types, according to Cope and Whiteaves, and its flora is akin to that of the Upper Cretaceous. The Upper Laramie has afforded a flora so modern in aspect that it has even been regarded as Miocene, though in reality not later in age than the Eocene. The Willow Creek or Middle Laramie division may therefore (as suggested by the author in his memoir of last year on the Western Cretaceous) be regarded as the transition from the Cretaceous to the Eocene.

The question of the correlation of the Laramie with other formations has been much complicated by the reference in the United States and elsewhere, of beds holding its flora to the Miocene period, and these difficulties cannot as yet be wholly overcome, though they are gradually being removed. In Canada, since the plants began to be collected and studied, there has been little doubt on the subject, and the author now, as heretofore, holds to the correlation with the Laramie flora of the so-called Miocene of Mackenzie river, Alaska, Greenland and Spitzbergen, and believes that they should be regarded as not newer than Eocene.

The greater part of the paper is occupied with the description of the fossil plants of the formation, including those collected in the Eastern area by Dr. Selwyn and Dr. G. M. Dawson, and those obtained from the Western area by the latter, Mr. Weston, Mr. Tyrrell and the author. These include a large number of exogenous trees, all belonging to modern genera, as Platanus, Corylus, Populus, Salix, Viburnum, Carya, Juglans, etc. There are also some curious plants allied to the modern trapa or water chestnut and coniferous trees of the genera Taxodium, Sequoia and Salisburia, as well as some ferns and equisetaceous plants of

much interest, more especially in reference to their geological and geographical distribution.

NOTES ON THE VARIATION OF CERTAIN TERTIARY FOSSILS IN OVERLYING BEDS.—In the Southwestern Old-tertiary there are some high vertical exposures, which show different fossiliferous beds vertically above each other. One of them is the profile near Vicksburg, described in the *Amer. Journ. of Science*, XXX, 1885, p. 71. The "Higher Vicksburgian," consisting mainly of reddish sands, contains those fossils usually known as Vicksburgian fossils; the bed, "Lower Vicksburgian," a dark grayish marl, contains a very similar but not entirely identical and less numerous fauna; both are separated by about thirty feet of limestone. Some of the lower species are not known from the higher bed, which, however, is at least partly owing to different methods of collecting in both beds. The main number of species of the lower bed occurs also in the higher one. In most of them, for instance, *Buccinum mississippiense* Conr., *Sigaretus mississippiensis* Conr., *Pleurotoma congesta* Conr., *Murex mississippiensis* Conr., *Terebra divisura* Conr., *Trochita trochiformis* Lea, *Turritella cælatura* Conr., I cannot detect differences between the forms in the higher and lower bed; but in two cases at least there occur differences; *Cytherea sobrina* Conr. from the lower bed is in general longer than from the higher bed. Ten specimens of the higher bed, taken without special selection, showed, if the height is put as 1.00, a length varying from 1.19 to 1.29, with an average length of 1.23. Ten specimens of the lower bed, also taken without special selection, had a length varying from 1.24 to 1.33, with an average of 1.30. More striking is the relation of the two forms of *Ficus mississippiensis* Conr., which species in the lower bed is quite common. In the form of the higher bed the revolving lines are more developed. On the end volutions of the same age and size in both varieties, the higher variety shows one more system of revolving lines. This difference between the two varieties is not very striking, but is large and constant enough to distinguish the forms of the two beds without reference to the lithological contents of the shells. The following diagram represents the plan of the origin of the revolving lines as they can be traced along the volutions of each form:



I, lines of the form of the "Lower Vicksburgian;" II, lines of the form of the "Higher Vicksburgian."

The conclusion to be made is that the two species changed somewhat during the time which is represented by the bed of limestone.

By the Geological Survey of Alabama there has been made out, by a series of profiles, that certain fossiliferous Tertiary beds are successional in age, for instance, that the Woods Bluff beds are older than that of Hatchitigbee bluff, this again is older than the Lisbon strata, which finally are overlaid by the Claibornian. In these consecutive beds we frequently find the same species, sometimes without apparent change, sometimes represented by slight variations and in some cases by strongly modified variations. This material from Alabama, which I refer to, is in the collection of Mr. T. H. Aldrich.—*Otto Meyer.*

GEOLOGICAL NEWS.—*General.*—Capt. Dutton, in his memoir upon the volcanoes of the Pacific islands, examines and rejects the following four theories of the origin of volcanic action: (1) Access of water; (2) penetration of oxygen; (3) mechanical crushing through the horizontal pressure due to the cooling of the interior; (4) local development of heat from unknown causes. Elevatory movements are by him referred to expansion or to an increase of matter, and the former hypothesis is accepted as agreeing best with observed facts.——Among the samples of rocks collected during the soundings of the *Talisman*, mostly from depths of 4000 to 5000 meters, the older metamorphic rocks are more generally represented than the eruptive series. There were seventy-three specimens of limestones, sixteen of arkoses and nineteen of sandstones, the latter sometimes rich in remains of biotite and muscovite.——From the collections of Lieut. Giraud it appears that the region of Lakes Tanganyika and Nyassa is principally composed of primitive rocks. Schistose rocks, containing remains of Lepidosteus, were collected at Yendivé, south of Tanganyika, and at Mpasa, north-west of Nyassa. These are referred by Reymond to the Upper Cretaceous or Lower Tertiary age.

Palæozoic.—The occurrence of glacial conditions in the Palæozoic era was maintained by Dr. W. T. Blanford in a recent communication to the London Geological Society. The action of ice was evident in the Karoo formation of South Africa, the Gondwana system of India, and the coal measures and associated beds of Eastern Australia. Mr. R. Oldham, the Rev. W. B. Clarke and others had clearly showed that in Australia beds, containing Glossopteris, Phyllotheca and Nœggerathiopsis were intercalated among marine beds and Carboniferous fossils. Abundance of smooth and striated boulders had been found by Mr. Oldham in the marine Carboniferous beds north of Newcastle, N. S. W. Other boulder beds existed in the Talchir beds of India, and also near Herat in beds also containing Talchir fossils. Dr. Blanford considered it probable that these boulder-beds

marked approximately the same glacial period, which probably occurred towards the close of the Palæozoic, and resulted in the extinction of many of its peculiar forms. The peculiar flora of the Newcastle beds and of the Indian Damudas proved the existence of botanical provinces in past ages.

Tertiary.—M. Cotteau has submitted to the Paris Acad. of Sciences a description of the Eocene species of the echinid genera Sarcella, Gualtieria, Echinocardium, Leiopneustes and Brissospatangus. *Sarcella sulcata*, peculiar to the Upper Eocene beds of Biarritz, is remarkable for its large and strongly strobiculated tubercles, the arrangement of its internal fasciole and the peculiar structure of its ambulacral areas; *Leiopneustes antiquus* has no fascioles; and *Brissospatangus canmonti* may be known by its very excentric anteriorly placed ambulacral summit and its short, transverse and widely separated anterior paired ambulacra, situated in a depression. The Brissidæ appear in the Cretaceous, reach their maximum in the Tertiary and still persist in most seas.——The Cretaceo-Eocene limestones of the Jaulan and Hauran regions, described by Mr. G. Schumacher, seem to have been deposited, upraised and largely denuded, before the volcanic lavas of the district were forced out. As this movement and denudation took place in the Miocene epoch, the volcanic eruptions may be referred in the main to the succeeding Pliocene.——The so-called delta of the Orinoco, according to A. Ernst (*Nature*, Feb., 4th), has not been formed by the river. At the end of the Tertiary period a sudden subsidence formed the Golfo Triste, the Gulf of Cariaco and many of the lagoons in the provinces of Cumaná and Maturin. The southern branch is the old river channel, but when the land on the left bank sank gradually towards the north, part of the waters, following the new slope of this northern plane, cut into it the various channels with their connecting branches which, after a slow and tortuous course, empty into the sea between the old mouth of the river and the southern entrance of the Golfo Triste. At the time of this movement extensive tracts of land to the north of the mountains which run through the whole length of the peninsulas of Araya and Paria were also submerged and thus the Sea of Carupano was formed. Previous to this the South American mainland (as shown by Mr. Bland in his investigation of the West Indian shell fauna) extended to Grenada, Tobago and Trinidad. Tobago is still within the 100 fathom line. It is evident that an immense quantity of organic matter must have been buried with the sunken land to form the source of the bitumen and other carbo-hydrates of the vicinity.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—Renard, in the course of his work on the rocks collected by the *Challenger* in 1874, has found some interesting material among the specimens collected from the volcanic islands in the Polynesian group. Most of the larger islands he thinks will be found to consist of crystalline schists, which the ancient and younger lavas have in turn overflowed and concealed. As evidence of the fact that some of the rocks found in these islands are of pre-Tertiary age, Renard describes[2] two slides from Cebu, one of the Phillippine group. One of these consists of porphyritic crystals of olivine, Baveno twins of Bytownite or labradorite and broken crystals of augite in a microcrystalline ground-mass of plagioclase, augite and viridite, possessing a well-marked flow structure. As all the constituents are much altered, with the production of considerable epidote, the author supposes this rock to be an olivine diabase or a melaphyre. Under the influence of the gaseous emanations from fumaroles the plagioclase is changed into a mixture of albite, saussurite and epidote, the bisilicates into chlorite and pyrite. Gypsum associated with pyrite is a frequent result of the action of sulphuric acid vapors on both older and young lavas. On the Island Malanipa serpentine occurs. This is cut in all directions by veins of chalcedony, and is obviously the result of the decomposition of peridotite. Quite a number of slides of specimens gathered from the Moluccas,[3] Banda[4] and the Fiji[5] islands were examined. They prove that the predominating rock on all these islands is augite andesite. On the Island Ternate,[3] which consists almost entirely of a single volcanic peak, in addition to the andesite there occurs basalt. The former rock is composed of a glassy base with numerous devitrificative products and porphyritic crystals of zonal labradorite, twinned, pleochroic augite with an extinction of from 44°–50°, and magnetite. In the augite the pleochroism is $a + b > c$. By the action of the volcanic
reddish-yellow greenish
gases the basalt is almost completely changed into a quartziferous aggregate in which are occasional grains of augite and plagioclase, and very rarely the remains of olivine. In an altered rock from Banda[4] the plagioclase crystals are filled with cracks and fissures, into which a colorless isotropic substance has penetrated, in many instances replacing entirely the feldspar. A chemical analysis of the fresh unaltered andesite from this island shows it to contain from fifty-six to fifty-nine per cent of silica, while the altered variety contains as high as ninety per cent.

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.

[2] Bulletin de l'Acad. Roy. de Belgique, III, 2, p. 95.

[3] Ib., III, 2, p. 105.

[4] Ib., III, 2, p. 112.

[5] Ib., III, 2, p. 156.

Opal replaces the original constituents of the rock, first replacing the feldspar, then the augite and finally the glass base. Occasionally this silica takes the form of tridymite. Near the port of Kantavu, on one of the Fiji[1] islands, quite a number of hornblende andesites were found. In a yellowish glassy base, containing numerous microlites of feldspar, augite and grains of magnetite, large porphyritic crystals of labradorite, hornblende and biotite occur. The hornblende often possesses the two pinacoids well developed. In some cases this mineral is surrounded by a rim of small, colorless or very light-green augite crystals, arranged with their long axis parallel to the long axis of the hornblende. In other cases the hornblende passes over into a perfect pseudomorph of brown biotite, which can be distinguished from the original biotite by the fact that the hexagonal sections of the secondary mineral are composed of tiny fibers lying parallel to one of the pinacoids of the hornblende from which it was derived, while those of the original biotite appear homogeneous.——Fouqué reports[2] that the rock of Gamboa, on the line of the Panama canal, is an augitic labradorite containing hornblende. The porphyritic crystals of labradorite, augite and magnetite occur in a microlitic base, which has been transformed in greater part into chlorite.——The rocks collected during the cruise of the *Talisman*, in 1883, have been given to Michel Lévy for examination. Two hundred and fifty slides of specimens collected between the depths of 4000–5000 meters have been examined. By far the largest number of these are of rocks of the "old metamorphic series."——The igneous rocks of the ridge known as Stanner rock, near old Radnor, Shropshire, England, are stated by Cole[3] to consist of an acid series intrusive in a more basic series. The most highly crystalline member of the former is a "pale pink-grey pegmatite," passing through a well-defined graphic granite into a micropegmatite form. The less crystalline members of the acid series are felsites with well-developed spherulitic structure. Corroded quartzes, surrounded by the the "quartz globulaire" of Fouqué and Lévy, were observed in most of these felsites. The more basic series is composed of diabases, diorites and rocks intermediate between these, with a few in which the author thinks he has found evidence of previously existing olivine.——Chrustschoff has just published[4] an interesting article on "pyrogeous quartz and tridymite." Inclusions of granite and quartz in the basalt of Striegan were partially dissolved, and around them a secondary crystallization of quartz took place. These new crystals are frequently bounded

[1] Bulletin de l'Acad. Roy. de Belgique, III, 2, p. 156.

[2] Comptes Rendus, CII, No. 14, p. 793.

[3] Geological Magazine, May, 1886, p. 219.

[4] Mineralogische und Petrographische Mittheilungen, VII, p. 295.

by crystal planes. They enclose glass areas which are derived from original inclusions, and contain also fluid inclusions with movable bubbles. Tridymite is much more rare under these conditions than quartz. It is usually found lining cavities around the periphery of glass particles or veins, and is generally free from inclusions. The granitic feldspar is likewise in many cases surrounded by a rim of "neogenous" feldspar, which frequently builds around the original irregular fragment a completely developed crystal. The newly-formed feldspar is much less opaque than that from which it was derived, and contains fewer inclusions. Among those that occur are little fluid cavities containing movable bubbles. A most instructive portion of the paper is that which treats of the experiments which were undertaken by the author to explain the origin of the secondary fluid inclusions, and to find the conditions under which the silica separated out in crystal form.——Pöhlman[1] has recently described biotite-gneiss, quartzite, olivine-kersantite and nepheline-basalt from the northern part of Paraguay. The olivine-kersantite contains, in a dark gray ground-mass, large crystals of biotite (meroxan), perfectly fresh augite and flesh-colored pseudomorphs of olivine. These pseudomorphs consist of serpentine, very pleochroic bunches of a micaceous mineral, carbonates and iron oxides.——According to Carl Ochsenius,[2] the blue color of much of the Strassfurt salt is not due to sulphur, but is merely an optical effect.

Mineralogical News.—Emmonsite, a new mineral from near Tombstone, Arizona, has been described by W. F. Hillebrand.[3] It is of a yellowish-green color, translucent, and occurs in crystalline scales and patches in a brownish gangue composed of lead carbonate, quartz and a brown substance containing iron, tellurium and water. The mineral is probably monoclinic, with a good cleavage parallel to the clino-pinacoid. Cleavage pieces show two other directions of imperfect cleavage nearly at right angles to each other. Against one of these the extinction is 8°–12°. Pleochroism very slight. Specific gravity about 5. After allowing for impurities the mean of four analyses was as follows:

Te	Se	Fe	H_2O
58.75	0.53	14.29	above 3.28

It is most probably a hydrated ferric telluride.——Twins of cinnabar[4] have been found in the recently discovered ore deposits in the neighborhood of Bachmut, Ekaterniosław, South Russia. The crystals are inter-penetration twins with the base the twinning plane and the twinning axis the vertical axis. The planes

[1] Neues Jahrbuch für Min., etc., 1886, I, p. 244.

[2] Ib., p. 177.

[3] Proceedings Colorado Scientific Society, Vol. II, Pt. I, 1885, p. 1.

[4] Ischermak. Miner. u. Petrogr. Mitth., VII, p. 361.

on each crystal are R, 2R, and the trapezohedron $\frac{2P\frac{3}{2}}{4}$. When the tetartohedral plane is on the right edge of an upper rhombohedral face the crystal is dextro-rotatory.——The jeffersonite of Franklin, N. J., has been investigated crystallographically and chemically by Kloos, of Stuttgart.[1] In the prismatic zone only $\infty P\breve{\infty}$ and ∞P were found. The crystals were terminated by oP, $\pm$P, $2P\breve{\infty}$ and 3P3. The pleochroism is strong $\mathfrak{a}$ = honey-yellow, $\mathfrak{b}$ = yellow-green, $\mathfrak{c}$ = blue-green. Absorption $\mathfrak{c} > \mathfrak{a}$. Sections parallel to the clino-pinacoid gave an extinction of 17° 15′ against the vertical axis. Specific gravity 3.352. A chemical analysis yielded:

SiO_2	TiO_2	Al_2O_3	Cr_2O_3	Fe_2O_3	FeO	MnO	ZnO
39.59	1.76	11.20	0.13	5.97	11.31	3.07	0.53

MgO	CaO	Na_2O	K_2O	H_2O	total
8.42	12.85	3.31	1.95	1.02	101.11

In the light of this result the author does not feel justified in assigning to this mineral any definite constitution. The small amount of MnO would seem to indicate that the mineral under investigation is not a true jeffersonite.——Brauns[2] has discovered a new plane $\frac{17}{10}P\overline{\infty}$ in manganite from near Oberstein a. d. Nahe. ——In the clefts of a piece of soapstone from Göpfersgrün, near Wunsiedel, Sandberger[3] has found uranite and torbernite in little quadratic tables. Pseudomorphs of arsenio-siderite after siderite from Bulach in Würtemberg and greenockite from the clefts of zincblende from Brilon, Westphalia, and Neu-Sinka, in Siebenbürgen, were also found and examined by the same investigator.

BOTANY.[4]

FIGURES OF SOME AMERICAN CONIFERS.—Dr. M. T. Masters read a paper entitled "Contributions to the history of certain species of Conifers" before the Linnean Society, in January of the present year, in which some American species are critically discussed. They are as follows, viz:

Abies amabilis Forbes. This is accompanied with a nearly full-sized figure of the cone, a photo-engraving of a sterile branch, with half a dozen enlarged figures of leaves, leaf-sections, bracts, scales and seeds.

Abies grandis Lindley. A large double plate showing five cones, with figures showing details of leaf and cone structure, illustrate this species. The variety *lowiana* (= *Picea lowiana* Gordon, *Picea parsonsiana* Barron, *Abies lowiana* McNab) is described and figured. A second variety, *pallida*, is doubtfully separated. Its leaves are "of unequal length, flat, and pale in color."

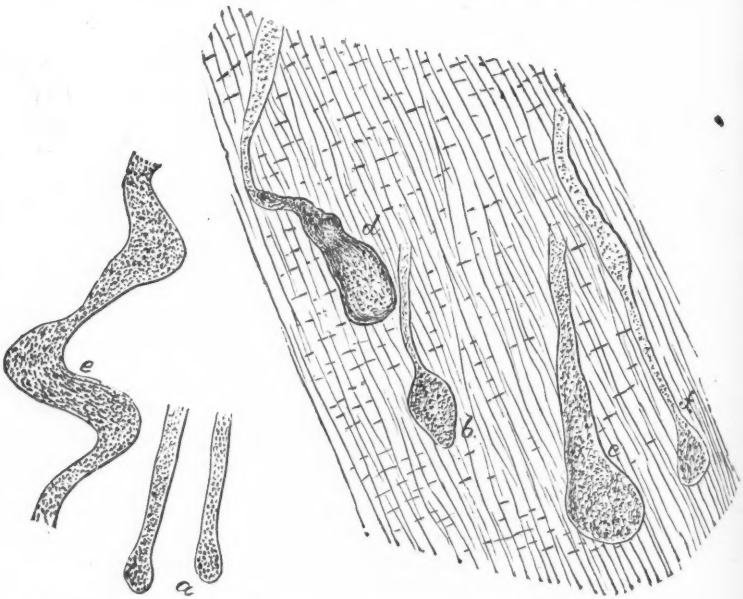
Abies concolor Lindley. Figures of the cone, foliage, leaf-structure, bracts and scales illustrate this species.

Abies subalpina Engelm. Full illustrations accompany the description of this species.

[1] Neues Jahrb. für Min., etc., 1886, I, p. 211.
[2] Ib., p. 252.
[3] Ib., p. 250.
[4] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

Abies nobilis Lindley. The typical form of this species is illustrated by a large double plate showing the foliage and cone, with details of the latter. The variety *glauca* occurs in cultivation. The variety *magnifica* (= *Abies magnifica* Murray) is illustrated by a large double plate showing cones and foliage. Details of the leaf and cones are given in wood-cuts.

STRANGE POLLEN-TUBES OF LOBELIA.—The pollen-tube as figured in the text-books and elsewhere is of nearly uniform diameter throughout its whole length. The lower portion, or that farthest from the grain (or spore) is usually shown with its contents denser than elsewhere. In the style of the *Lobelia syphiltica* I find that the ordinary form of the end of the pollen-tube is as shown at *a*. Occasionally the enlargement at the tip takes the form of nearly a perfect sphere. A spade-like form met with is



shown at *b*. At *c* is shown a pollen-tube tip that is quite exceptional. The end through the thickest part is fully four times the ordinary diameter of the tube. A still more irregular tip is shown at *d*. The tube is much swollen at the extremity, while back from the end are two contractions, after which the tube is attenuated for a distance upward and again assumes its normal size. These changes in size do not all take place in the same plane. The tube twists in various directions in the substance of the style. The extent to which this variation from a direct course may proceed is seen at *e*, which shows a portion of a pollen-tube

probably only a short distance behind the tip. The end in this case was not found. The twisting increases the chances of a single tube not holding together when subjected to the razor or needles of the investigator.

All of the parts of the illustration were drawn with a camera lucida—a Grunow, which thus far has proved itself among the best. The tubes *b c d* and *f* hold the same positions to each other as they did in the conductive tissue of the style. This was an unusually rich spot in odd forms. The conductive tissue seemed loose, and there was no apparent cause for any change of direction or the formation of enlarged end. No nucleus was observed in any of the tuber-like tips. I hope to cultivate the pollen free from any tissue and observe the results.—*B. D. Halsted, Botanical Lab. Agricul. Coll., Ames, Iowa.*

Books on Fungi.—The American student of fungi is often sorely puzzled for want of a systematic manual to aid him in his study and classification of the multitude of species which he collects or *might collect* if he could hope to do anything with them. The book which has been of most service is probably Cook's Hand-book of British Fungi, published about fifteen years ago, but its descriptions are so imperfect and the system of classification so antiquated that from the first it has been an exasperating book to use or to put into the hands of students. Of American books there are none. We have some local lists and a good many scattered papers. Dr. Farlow has given us excellent monographs of several genera. Mr. Peck has likewise published many descriptions and a number of monographs. Mr. Morgan has helped us by giving us his Mycologic Flora of the Miami valley, Ohio. Ellis and Everhart have published monographs of a number of genera. By securing complete sets of *Grevillea*, the *Torrey Bulletin*, *Botanical Gazette*, *Journal of Mycology*, American Naturalist and the proceedings of several scientific societies, and in addition the reports and bulletins issued by various States and colleges, one can do something, but how many, aside from the specialists, can afford to supply themselves with all these?

Two books now publishing will do much to help the ordinary botanist and botanical student. Several years ago Dr. George Winter began the publication of a new edition of the volume "Die Pilze" (fungi) of Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. The first book of this work was completed in 1884. It includes the Schizomycetes, Saccharomycetes and Basidiomycetes. This latter class, in accordance with Winter's views, is made to include the Entomophthoreæ, Ustilagineæ and Uredineæ, in addition to the Tremellineæ, Hymenomycetes and Gasteromycetes. The second book has progressed as far as p. 592, and is thus far devoted to the Ascomycetes. From present indications this book at least will be required for the Ascomycetes, and a third book will be neces-

sary for the three remaining classes, viz., Myxomycetes, Zygomycetes and Oömycetes. The great value of this work lies in the fact that the descriptions are very full, and include accurate measurements.

In the year 1882 P. A. Saccardo began the publication in Padua, Italy, of what is destined to be one of the great books of the century, the Sylloge Fungorum, designed to contain all the known fungi of the world. The first and second volumes are devoted to the Pyrenomycetes, of which great group about 6000 species are described. The third volume, devoted to the Sphæropsideæ and Melanconieæ, appeared in 1884. It contains descriptions of over 4000 species. Volume IV appeared in April of the present year. It is devoted to the Hyphomycetes, and describes over 3500 species.

The descriptions in Winter's work are in German, those in Saccardo's Sylloge, in Latin. Both are full, although the treatment is much more satisfactory in the former. Saccardo merely compiles, and thus often admits the same plant under more than one name, while Winter is exceedingly critical. The latter is therefore the better guide, while the former, by his liberality in admitting so many descriptions, makes these available for the critical study of students everywhere.—*Charles E. Bessey.*

A POCKET MANUAL OF BOTANY.—It would puzzle any one to make out just what the publishers of the ordinary botanical manuals had in mind when they decided upon their type, paper and binding. A manual ought to be a field book. It should be portable, with a size and weight allowing it to be carried as the companion of the collector wherever he goes. Every beginner in systematic botany ought to carry his manual with him, but it is too much to ask him to carry a two-pound book in addition to his other burdens, especially when the book is too big to go into any of his pockets. Nearly five years ago the writer brought this matter to the attention of publishers (AM. NAT., Vol. XV, p. 896) and some favorable correspondence resulted from it. But we still have the old-fashioned coarse print, thick paper, broad margined, clumsily bound manuals for use in the schools and colleges.

In the "Tourists' edition"[1] of Coulter's Botany we have the nearest American approach to the style of book with which collectors and students should be supplied. By the use of thin paper the thickness of the book is reduced to considerably less than an inch which, with the flexible leather binding, makes a book which can be carried much more comfortably than could the ordinary edition. Had the binder been instructed to trim the pages so as to leave a much narrower margin all around, the book would have been much improved. In order to test the

[1] Coulter's Manual of Rocky Mountain Botany. Tourists' edition. Ivison, Blakeman, Taylor & Co., New York and Chicago, 1885.

matter the writer took his copy to a binder and had the margins cut down, resulting in what is probably the handiest botanical manual in the country. This improved copy is now exactly seven and three-eighths inches long and four and seven-eighths wide, and weighs but thirteen ounces. It slips into an ordinary pocket with the greatest ease, and can be carried by the collector wherever he goes.

Now it must be remembered that this reduced copy of the "Tourists' edition" is printed from the identical plates used for the large book, and that apparently no attempt was made by the printer to reduce the size of page by printing closer to the *inner margin*, where at least a quarter of an inch might easily have been saved. It is probable that with considerable care the width of the book might be reduced to four and a half inches.

Until we can have something better let us have thin-paper editions of Gray's, Coulter's and Chapman's manuals, printed and bound with narrow margins *all around*, and with flexible covers which project but little if at all beyond the pages. Then let our publishers seriously consider the problem of giving us all this at a moderate cost.

When new editions of these manuals are made, the publishers can save much space by the use of thinner leads, so as to crowd the matter closer upon the pages. In this way not far from seventy-five pages might be saved, while by the use of smaller type here and there the saving might be easily carried to a hundred pages. A little book of 392 pages—the Tourists' Guide to the Flora of the Alps—lately issued by an English firm, might well be taken as a model. Of it a recent reviewer says: "Printed in clear type on thin paper, and bound in red leather in pocket-book form, it weighs less than five ounces, and is thus really suited for the pocket." And yet this book is sold for five shillings, that is, for about two-fifths what is charged for Coulter's "Tourist!"—*Charles E. Bessey.*

A CHEAP HAND-BOOK OF MOSSES.—One of the neatest little botanical books which has appeared for many a day is the Hand-book of Mosses, by J. E. Bagnall, and published by the well-known London firm of Swan Sonnenschein & Co. It is a thin duodecimo book of about one hundred pages, contains thirty-nine illustrations, is bound in cloth with tastefully ornamented cover, and sells for one English shilling.

The chapters treat of the following topics, viz: Appliances and material required for the study; development; moss habitats; classification; geographical distribution; cultivation; uses; preparing specimens for the cabinet and herbarium. The chapter on classification treats the subject in a general way only, giving no more than the characters of the tribes.

We wish it were possible for American publishers to put a book of the quality, size and price of this one upon the market.

BOTANICAL NEWS. — Professor Seymour's lecture before the Minnesota Horticultural Society, in January last, is a model of what such a lecture should be. It deals plainly with a few common but imperfectly understood fungi of the fruit-garden, viz., the rusts of the raspberry and blackberry (*Cæoma nitens* and *Phragmidium rubi-idæi*); the "double blossom" of the blackberry (*Fusisporium rubi*); the raspberry "cane rust" (probably *Sphaceloma ampelinum*); and the currant disease (*Septoria ribis*). The lecture, now published in pamphlet form, closes with a few well-chosen remarks about the investigation of the parasitic fungi.——Professor Tracy has just published in the eighteenth annual report of the State Board of Agriculture a catalogue of the flora of Missouri. It includes phanerogams and pteridophytes only, and yet there are enumerated 1749 species. A study of the list shows the State to contain four well-defined botanical regions: (1) The Mississippi and Missouri *river-bottoms;* (2) the *swamp region* of the south-east; (3) the *Ozark region*, south of the Missouri river; (4) the *prairie region* of the northern and western portions of the State.——The Botanical Club of the American Association for the Advancement of Science will hold meetings in August at Buffalo, and will meet with a warm reception from the botanists and citizens of Buffalo. Although the arrangements are not yet completed, it can quite confidently be announced that the club will be tendered a half-day excursion to some one of the several interesting collecting grounds of that vicinity. The long excursion on Saturday will also be arranged to enable the botanists to have a portion of the time for collecting. The localities near the city which have been described by Mr. Day in his catalogue of Buffalo plants will prove as interesting to visiting botanists as those of any city yet visited by the club. There will also be tendered to the club, without doubt, an evening reception. There will be no lack of opportunities for becoming acquainted with one another. The first meeting of the club will be held in the room assigned to biology on Thursday morning at 9 o'clock, which is the second day of the association. Subsequent meetings will be announced on the daily programme of the association. It is hoped that the botanists will be out in still larger numbers this year than they were last, or the year before. Let every teacher of botany arrange now to be present at the meetings. The secretary of the club is J. C. Arthur, of Geneva, N. Y.

ENTOMOLOGY.

DESCRIPTION OF THE FORM OF THE FEMALE IN A LAMPYRID (ZARHIPIS RIVERSI HORN.)—

♀. Apterous, vermiform, segmented, retractile, phosphorescent. Number of joints, exclusive of the head, twelve. Legs six, two on each of the three anterior segments, or on those portions underneath representing the pro, meso and metasternum. Length, when extended in walking, two and a quarter inches; and the width across the widest part five-sixteenths of an inch.

Head corneous, shining black and not well defined and when at rest hidden beneath the anterior segment. The prominent character of the head consists of a pair of curved hook-like mandibles like those of the male. Antennæ short, straight, four-jointed; the apical joint bristle-like and growing out from the side of the end of the previous joint, which is the largest and tubular in form.

Maxillary palpi five-jointed, four being nearly equal and bead-like.

Labial palpi appear two-jointed. The antennæ and palpi being short, stand stiffly out from their base.

Dorsal surface consists of twelve thin corneous plates, the three anterior being narrowed in front and all having an impressed line through the center. The plates are shining, blackish brown, margined transversely with transparent olive green, and upon the longitudinal margins with opaque pale yellow interspersed with olive, which colors intermixed obtain upon the sides and the underparts generally.

Spiracles upon the sides of the fourth to the eleventh segments, inclusive, and just below the spiracles on the same segments is a double fold forming a double lateral ridge. The other segments bear but a single fold and no spiracles.

The thoracic region bearing the legs exhibits indistinct sutures and folds presenting but a faint resemblance to analogous parts in other Coleoptera.

The legs are of the type seen in the female in some Lampyridæ and are four-jointed with a short obtuse tarsal claw. The legs in the larval stage of this insect differ from those in the adult by being flattened on the under side into a ridge which is strongly setose, and the claws of all the legs are twice as long, more curved, finer and more sharply pointed than in the fully grown insect.

In Bull. Cal. Acad. Sci., II, 5, p. 71, April, 1886, are to be found some references made by me to a large luminous larva of some coleopteron, and I also gave an account of its habits. This luminous larva, then alluded to, is an earlier stage of the insect I have described above.

The larva fed all winter, and in March sloughed its skin and remained motionless, coiled in a cell of earth for three weeks, and kept a uniform pale-cream color without luminosity, but gradually the center of the dorsal plates became darker, and in the ratio of coloring so was the reappearance of phosphorescent light; when fully restored in strength it became very active and strongly luminous, but it did not eat. In about a week it disappeared beneath the earth, and remained out of sight for nearly a month, and thinking it had changed into the pupa state I disturbed it, and found no change to have taken place. I returned it to the jar, placing the coiled insect upon the top of the earth, where it lay motionless for two days. On the morning of the third day I found it had sloughed another skin, but this time a very thin covering of uniform pale brown, and the insect itself had disappeared into the earth. This last dormant stage must represent its pupa state. I unearthed it again and found it very soon afterwards to assume great activity and bright luminosity, but it would take none of the usual food. Thinking a fresh supply of earth to be beneficial, I removed the jar into the garden and emptied the earth by the stump of a tree, and while in this act several specimens of Zarhipis pitched upon the discarded earth, and one specimen dropped swiftly upon the until then supposed larva, throwing the female into violent movements by the suddenness of the attack. The male soon attempted copulation. The act, if it really took place, is not one of adhesion like that

in the Telephoridæ. The method was alike in a number of examples, the attraction of the female was perfect, and through it I captured eleven males.

The light occurs most intense on the cross margins of the dorsal plates, but the luminosity is also strong on all the margins as well as along the lateral edges. Sometimes the insect appears checkered by being banded with phosphorescence.

The eleven males attracted were not all of the form known as *Z. riversi* Horn; some represent the *Z. piciventris* Lec. These facts will cause some revision of the genus.

The foregoing statements can hardly be considered as a perfect history of this peculiar insect, because there are many points not yet worked out.

Why the larva should be luminous, and yet have nothing to attract, and why the adult ♀ should be luminous, while the ♂ is not nocturnal, but roams in the sunlight, are still unanswered questions. The habit of the male is to appear on the wing, in temperate heat, from 9 A. M. to 4 P. M., but during the hottest weather it does not appear until the sun is declining.

Then what are the differences in the larval form of the sexes, or, are there any larval differences of the sexes? The answer to these queries will come after observation; but the answer to the one concerning the luminous characteristics of the larva and adult form may perhaps give way to theory and it may be suggested that the luminous quality is inherited, and though without use to this species having a diurnal habit, yet it may be a derived character that only comes into use when the habit is nocturnal. But it must be considered that the plumose antennæ of the male would indicate that it seeks its mate by scent.—*J. J. Rivers, Univ. of Cal., Berkeley, Cal.*

History of the Buffalo Gnat.—The report of the U. S. entomologist for 1884 contained an article on the subject of the Southern buffalo gnat (Simulium sp. or spp.) which discussed the great damage done to stock each year along the Lower Mississippi and the habits of the allied species in this country and in Europe. At that time the particular species concerned had not been determined nor had the larvæ and pupæ been found. The habits of the insect in its earlier stages were surmised to be similar to those of allied species, but as the species that had been studied, breed, as a rule, in streams that are clear, rapid and rocky, it was a question how the insects bred in such great quantities in the low alluvial Mississippi country. Considering the great damage done by these gnats it was also a question of considerable importance, as its solution might afford a means of checking the increase of the pest. The present spring Dr. Riley has therefore, with the aid of two of his assistants, Mr. F. M. Webster and Mr. Otto Lugger, endeavored to clear up the mystery surrounding this pest, and has already succeeded. Mr. Lugger, whose post has

been at Memphis, Tenn., has found the larvæ and pupæ of one species of Simulium, and Mr. Webster, at Vicksburg, has found the earlier stages of another, somewhat larger species. The habits of both species are similar, and both have been found to breed in the more swiftly-running portions of the smaller creeks and bayous which are permanent and do not dry up in midsummer. They are found attached to the masses of drift-wood and leaves which form at points and which, by impeding the streams below, form a more rapid current at the surface. The larvæ and pupæ have been absolutely connected with their respective adults, and a careful study of the general character of the breeding places already indicates that the increase of the pests of late years is indirectly due to the crevasses in the levees, and that we have here another strong argument for the preservation and care of these last.

Larval Form of Polydesmus canadensis.—While at Enterprise, Fla., I found, April 8th, under a palmetto log a *Polydesmus canadensis* with its body encircling a mass of white, oval eggs, each about half a millimeter in length and with a thin chorion. They were enclosed in a slight nidus. Placing the eggs and the myriopod, with damp sand and mold, in a close tin box, and bringing them home, I found the young had hatched about the 9th of May. The larva, soon after hatching, is short and thick, the body composed of eight segments and ornamented with scattered, large, somewhat club-shaped spines. The antennæ are four-jointed. There were only three pairs of legs, and they were appended to the first, third and fourth segments respectively, there being none on the second segment behind the head. Length of the animal $1.2^{mm.}$

The larva is essentially similar to that of the European *Polydesmus complanatus*, figured by Metschnikoff (*Zeits. wissen. Zool.*, xxiv, pl. xxvi, fig. 7), but apparently has one more segment.—*A. S. Packard.*

Occurrence of early stages of Blepharocera.—I send you by express a small package containing specimens of larval forms that I collected last summer at Gilboa, Schoharie county, N. Y. They were all found in the same situation, viz., on the rocks in a water-fall, at the place where the water ran most swiftly, generally on the edge of the rocks. The larvæ of the black fly were so numerous that the edges of rock were black with them. The mode of attachment to the rocks is by a chitinous ring, armed with longitudinal rows of hooks. The tubercle on the prothorax is also provided with a similar disk. These disks served as organs of locomotion as well as of attachment. Just above the disk, at the posterior extremity of the body, on the dorsal surface, there is an opening through which, in many specimens, a tufted organ appears, which I do not remember to have seen in other larvæ.

The intestine in the specimens is solidly packed with the remains of diatoms.

Of the other specimens I send, the one marked No. 3 seems to be the pupal form of No. 2. They were constantly associated, and I saw no other forms near them except the black-fly larvæ. The mode of attachment to the rocks is the same in both, by sucking disks. In No. 3 the disks were on the extremities of the abdominal segments, three on each side. In most cases in removing the specimens from the rock the disks were separated, but there is one specimen I send in which they are still in situ, and are very distinct, and I think they are shown in some of the others.

The protuberances on the dorsal surface of the head of No. 3 I supposed to be breathing organs, as they are composed of lamellæ which the animal had the power to open and close. There were numerous empty cases on the rocks, but they seemed to be only the abdominal disk-bearing segments, the upper or anterior portion being carried away by the rapid flow of water as soon as the animal deserted it.—*Fanny R. Hitchcock.*

[The insects have been identified for us by Dr. C. V. Riley.—*Eds.*]

Entomological Notes.—The Ceylon entomologists propose to systematically observe the singular migrations of butterflies in that island. Volunteers are to watch for the migration and send a post-card bulletin to the editor of the records, noticing data, direction of flight, of wind, the weather and the species.——Professor C. H. Fernald's "Sphinges of New England" gives descriptions of the moths and larvæ, the number of species being forty-two. It will prove to be a very convenient manual of our hawk-moths.——Dr. Uhler's Check-list of the Hemiptera Heterocera, published by the Brooklyn Entomological Society, is a timely publication. It is synonymical, and also gives the geographical distribution of the species. Having been compiled under difficulties it is not to be wondered at that a few species, even some of Dr. Uhler's, have been omitted. The number of described species is 1448.——Mr. W. H. Ashmead has published the seventh of his studies on the North American Chalcididæ. ——From Professor F. M. Webster we have received an essay on horticultural entomology, read before the Indiana Horticultural Society.——At the January 10th meeting of the London Zoölogical Society, Mr. H. J. Elwes read a paper on the butterflies of the genus Parnassius, with special relation to the development, functions and structure of the chitinous pouch found in the females. He had recognized twenty-three species.——Before the French Academy, J. Gazagnaire read a paper on the seat of the organ of taste in Coleoptera.

ZOOLOGY.

PHYSIOLOGICAL SELECTION.—At a recent meeting of the Linnean Society, Mr. G. J. Romanes read a paper "On physiological selection: an additional suggestion on the origin of species." The author contended that the theory of natural selection has been misnamed a theory of the origin of species. It is, in truth, a theory of the origin of adaptive structures, and, if unassisted by any other principle, could not effect the evolution of species. The only other principle that could here assist natural selection would be one that might mitigate the swamping effects of intercrossing. This may be done by geographical barriers shutting off a portion of a species from the rest, and allowing that portion to develop an independent course of varietal history without intercrossing with the parent form. It may also be done by portions of species migrating, changing habital stations, &c. But it may also be done by what the author calls physiological selection, or in virtue of a variation taking place in the reproductive system in the direction of sterility (whether absolute or partial) with the parent form, without impairment of fertility within the varietal form. For instance, the season of flowering or of pairing may be either advanced or retarded in a portion of a species, when all the individuals in that portion (or new variety) would be absolutely sterile towards the rest of the species, while completely fertile among themselves. They would thus start on an independent course of variated history.—*English Mechanic.*

MECHANICS OF SOARING.—Professor Hendricks in the NATURALIST for June, imports into the "mechanics of soaring" a momentary force which I do not think improves it. There is no "momentary" force concerned with any part of the activity that I am aware of. The birds are in the air quite early in the morning, and continue there until nightfall, all the forces concerned in their movements being active every instant of the time.

The air pressures beneath the surface produced by the normal motion are constant, and the expansion of these pressures against the rear curve is constant, and this expansion gives the lateral motion. They are both derived from the gravitating force of the mass of the bird. There is no other force operative upon the bird in the act of soaring.

Mr. Hendricks answers my "crucial" question in the negative; for, "there is an unbalanced force which acts downwards, and parallel with the face of the plane, and therefore towards the rest." But when an equal force acting in the opposite direction is opposed to it, there is no longer an "unbalanced" force acting, for the force is then balanced, and the plane in equilibrium. While the plane is thus in equilibrium a force will move it with equal facility in either direction, for to suppose otherwise is to suppose a force active in one direction which is not active in the other,

which is to deny the equality of the forces producing the balance.

Bear in mind that I have carefully excluded inertia, or in other words, mass acceleration, from the problem. The birds have the power of flapping, or falling from higher to lower levels, to initiate their movements. Soaring has nothing to do with acceleration. It deals with motions of uniformity only. Hence I am justified in holding that one or two pounds of constant pressure is competent to drive the plane edgeways 1000 feet per second against air friction only. As frictional air resistance approaches zero, a small force would move the plane against it with great velocity. No weight is lifted in the upward motion, as the forces producing the weight are already employed to their total value, as fully shown.

As the force producing the lateral motion is derived from the gravity of the mass, I am also justified in holding that a soaring bird is translated at right angles to the gravitating force, or horizontally, solely by the action of that force. It will be noticed that I have *assumed* the force derived from the rear expansion to be sufficient to give the lateral motion. When the wings of birds are examined the details of the lateral motion will be found. My concern in the "mechanism of soaring" was to show that the forces were on hand in quantity sufficient to produce the movement.—*I. Lancaster, Chicago, Ill., June 5th, 1886.*

LIMULUS IN THE PACIFIC.—My friend, Mr. H. W. Turner, of the U. S. Geological Survey, sends me an extract from the San Francisco *Evening Bulletin* of May 29th, which says: "A novelty on this coast was captured off the Farallone islands last Wednesday afternoon by Captain Camilio, who was fishing in his smack in that vicinity. Nothing like the crustacean had ever been seen on this coast before, and the fishermen thought they had made a capture that was valuable. It was found, however, that the prize was only a horseshoe crab, which is very common on the Atlantic coast. It is thought that the crab must have been hatched from eggs brought with the lobsters which were liberated in these waters seven or eight years ago."—*S. L.* [Can this have been the Japanese species?—ED.]

THE SWIM-BLADDER OF FISHES.—Charles Morris has published in the Proceedings of the Philadelphia Academy, a theory of the origins of lungs and swim-bladder, and an explanation of their homologies and the peculiarities of their relative positions. He imagines that the primitive fishes, like the sharks, were without this organ, but that some of them, venturing on land for longer or shorter excursions, took in stomach and throatfuls of air, which procured a certain aëration of the blood. He imagines that the air held in the throat finally produced a distension of its superior wall, which became later a diverticulum and still later a sac with a narrowed opening. The tendency to rise when in the water would ensure that this bag of air should maintain its

position above the œsophagus. In those fishes which continued to use air, as the Dipnoi, the sac became cellular and more complex. Its weight would then cause it to sink below the œsophagus, as we find it in Polypterus. From this stage the lung of air-breathers was derived. In those fishes which became most exclusively aquatic, the bladder underwent degeneration if it had acquired cells, and if not, remained a bladder only. In either case the loss of the connection with the œsophagus (ductus pneumaticus) is the final stage in this degeneracy.

This proposition of Mr. Morris is very plausible, and corresponds with the general course of evolution of the skeleton.

Dr. Paul Albrecht denies the homology of the lungs and swim-bladder in a pamphlet published by Carré, of Paris (1866). His reason is that the swim-bladder is on the dorsal side of the œsophagus, while the lungs are on the ventral side. He therefore regards the swim-bladder of Polypterus as a true lung, while that of Lepidosteus is a swim-bladder. In support of his view that these organs are respectively not homologous, he states that Diodon and Tetrodon possess both swim-bladder and lungs. The latter he recognizes in the diverticula from the lower side of the œsophagus, with which those fishes inflate themselves. He also sees a rudimental swim-bladder in diverticula from the superior side of the œsophagus which occur in some animals, for instance, in the pig.

The Former Southern Limits of the White or Polar Bear.—In my remarks on the occurrence of the white bear in Labrador, where it is sometimes called the "water bear," in distinction from the black bear, which is very common on that coast, I then supposed that the polar bear was a straggler from Hudson's and Baffin's bays, rather by accident than otherwise, at rare intervals breeding so far south as Labrador. But on looking over the accounts of the early discoverers and navigators, as well as Cartwright's "Journal," I am led to materially alter my opinion and to suppose that the former limits of this creature extended even possibly as far south as Casco bay, on the coast of Maine.

Whether there are any notices of or references to the white bear in the records and sagas of the Norsemen who visited the coast of Newfoundland and Nova Scotia, we are unable to say. White bears were, however, seen by the first English navigator who discovered our shores, the intrepid Venetian, John Cabot, then sailing under an English flag. The following reference to white bears appears in an extract from an inscription on the map of Sebastian Cabot in Hakluyt's Voyages (III, 27):

"In the yeere of our Lord 1497 Iohn Cabot, a Venetian, and his sonne Sebastian (with an English fleet set out from Bristoll) discouered that which no man before that time had attempted, on the 24th of Iune, about five of the clocke early in the morning.

This land he called Prima vista, that is to say, First seene, because as I suppose it was that point whereof they had the first sight from sea. That Island which lieth out before the land, he called the Island of S. Iohn vpon this occasion, as I thinke, because it was discouered vpon the day of Iohn the Baptist. The inhabitants of this Island vse to weare beast skinnes, and have them in as great estimation as we have our finest garments. In their warres they vse bowes, arrowes, pikes, darts, woodden clubs and slings. The soil is barren in some places, and yieldeth litle fruit, but it is full of white beares, and stagges far greater than ours."

This account shows quite conclusively that John Cabot's Prima vista was some point of land in eastern or northern Newfoundland. The eminent geographer, Dr. J. G. Kohl, in his History of the Discovery of Maine, seems fully persuaded that the landfall of John Cabot was Labrador. But if the inscription and map are genuine, the description of the inhabitants of the island, both men and beasts, would better apply to those of the eastern or southern coast of Newfoundland. The human beings were more probably red Indians than Eskimo. On the Labrador coast the soil is "barren" in all places, while the "stagges far greater than ours" may have been the moose, which does not inhabit the Labrador coast. Whether the "white beares" were the polar bears or a pale variety of the barren-ground bear of Sir John Richardson is somewhat uncertain. We should have unhesitatingly referred the creature to the polar bear, were it not that in Parmenius' account of Newfoundland, published in 1583, it is said: "Bears also appear about the fishers' stages of the countrey, and are sometimes killed, but they seeme to be white, as I coniectured by their skinnes, and somewhat lesse then ours" (Hakluyt).

The next explorer of this coast was Cortereal who, in 1500, landed on the Newfoundland coast, at or probably near Cape Race. In an old Portuguese map of about the year 1520 is a long Latin inscription, thus translated by Kohl, a part of which we copy: "This country was first discovered by Gaspar Cortereal, a Portuguese, and he brought from there wild and barbarous men and white bears. There are to be in it plenty of animals, birds and fish." The land from which Cortereal brought the white bears was evidently the same as that in which he kidnapped fifty-seven of the aborigines. These were Indians and not Eskimo, and must have been the inhabitants either of Newfoundland or of Nova Scotia, for a person who saw them in the streets of Lisbon described them "as tall, well-built and admirably fit for labor." That however they were the aborigines of Newfoundland, perhaps Bethuks, seems proved by the fact that a number of white bears were also captured and sent to Spain with them. From these facts it seems reasonable to infer that the white or polar bear was a resident on the eastern coast of Newfoundland.

The next navigator to explore these seas was Jacques Cartier, who arrived May 10th, 1534, on the eastern coast of Newfoundland. To this observing seaman we owe our first accounts of the home of the great auk or "penguin" on the Island of Birds, now Funk or Fogo island, on the northeastern coast of Newfoundland; also of the Bird rocks of the Gulf of St. Lawrence.

While harboring at what is now Funk island Cartier, after describing the great auks, tells us that he saw a white bear. In his own language, done into quaint English by Hakluyt: "And albeit the sayd Island be 14 leagues from the maineland, notwithstanding beares come swimming thither to eat of the sayd birds: and our men found one there as great as any cow, and as white as any swan, who in their presence leapt into the sea, and upon Whitsun-monday (following our voyage towards the land) we met her by the way, swimming toward land as swiftly as we could saile. So soone as we saw her, we pursued her with our boats, and by maine strength tooke her, whose flesh was as goode to be eaten as the flesh of a calfe two yeres olde."

From this graphic and circumstantial account we feel sure that this was the great white or polar bear (*Ursus maritimus*); that it reached its full size, was not uncommon on the mainland (John Cabot says the land was "full" of them), and that it bred there, as those mentioned by Parmenius in 1583 were probably young ones.

The white bear is still occasionally seen on this coast, as Rev. Mr. Harvey states:[1] "The seal hunters occasionally encounter the white or polar bear on the ice off the coast, and sometimes it has been known to land."

Now, if in these early times of Cabot and Cartier the eastern coast of Newfoundland was the habitat and breeding place of the polar bear, it is not unlikely that it occasionally might have visited, as we know the walrus did, the coast of Nova Scotia and of Maine.

Our supposition is based on the following facts: In an ancient map of "New France," by the Italian Jacomo di Gastaldi, in about the year 1550, republished by Kohl, and which we here present of reduced size, what we should consider as veritable white bears are depicted as swimming in the ocean far from the coast of what must have been Nova Scotia, and near to but west of Sable island or "Isola della rena." In the map the bears are placed to the southward of "Terra de Nvrvmbega," which evidently comprised Nova Scotia and Eastern Maine. Sable island is an enlarged portion of a broad band, intended to represent the banks of Newfoundland and La Have.

That the animals represented are bears admits of little doubt; of the four figures the lowermost one is a seal; it is drawn without ears, while the three other figures have large, drooping ears, like those of a bear. At any rate, if the locality was put in at

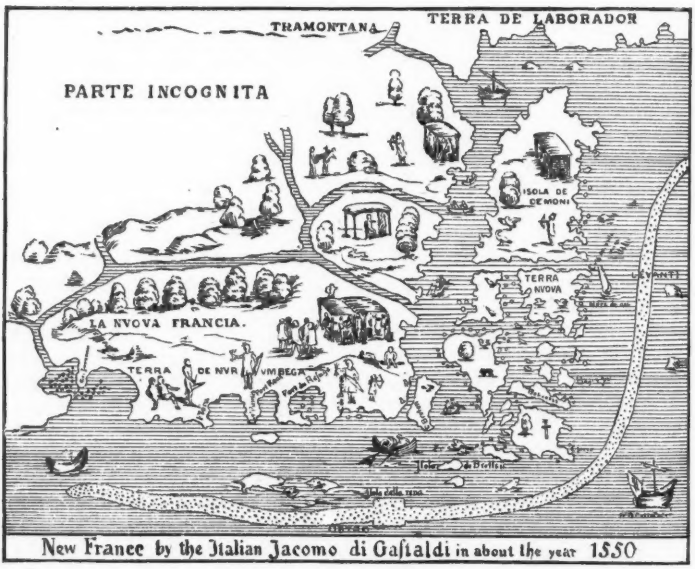
1 Halton and Harvey's Newfoundland, Boston, 1883, p. 193.

haphazard by the map-drawer, why should white bears be also represented, as they seem to be in the ocean off Isola de Demoni. The figures of the black bear, as well as of the rabbit and of the aborigines are well drawn, and it seems not unreasonable to infer that white bears were actually seen and reported to the south and west of Newfoundland.

That the white bear may have visited the coast of Maine, near Portland, is further proved by the probable discovery by Mr. E. S. Morse of a white bear's tooth in the shell heaps of Casco bay.

Speaking of the bones of the bear found in a shell heap on Goose island, Casco bay, Maine, the late Professor Wyman remarked in the AMERICAN NATURALIST, I, 575, January, 1868:

"The bones of the *bear*, though much less numerous, were



New France by the Italian Jacomo di Gastaldi in about the year 1550

similarly broken up, and in two instances had been carbonized by contact with the fire. Among the specimens collected by Mr. Muse in his first visit to Crouch's cove was the last molar from the lower jaw. The crown was somewhat worn, but the ridges were not all effaced; it was of small size, measuring 0.55 inch in length and 0.46 in breadth. The average size of eight specimens of the same molar in the black bear was: Length, 0.60 inch; breadth, 0.47, while that of two specimens from the polar bear was, length, 0.54 inch; breadth, 0.45. The tooth from the shell heaps, therefore, as regards size, more closely resembles

the last-mentioned species, as it does also in the shape of the crown—but it must be unsafe from a single specimen of the molar in question to attempt to identify them. The former existence of the polar bear on the coast of Maine is rendered quite probable by the fact that the tusk of a walrus has actually been found at Gardiner."

That the white bear formerly was an inhabitant of Newfoundland seems probable from the facts we have brought together, and it is to be hoped that the antiquarians and naturalists of Newfoundland will investigate the shell heaps, should such be found, of that island for further facts bearing on this subject.

We will now turn our attention to the former presence of the white bear on the Labrador coast, where the settlers still call it the "water bear." We find only in Cartwright's Journal reference to this creature, but this is sufficient to show that it bred on and permanently inhabited this coast from Belle isle or Chateau bay northward. A white bear was killed in 1769 at Pitt's harbor, Chateau bay. There is a "White Bear Sound" on Cartwright's map just north of Cape Charles, near Battle island. Cartwright's house was to the northward of Cape Charles, in an arm of Sandwich bay. In 1770 Cartwright saw the track of two large white bears, and the Eskimo killed one the same year near his house. In April, 1772, the tracks of three white bears were seen. In April, 1776, a white bear and cubs were seen near Huntington island, and in the following May another was observed. White bears were also seen up the rivers leading into Sandwich bay, and on pp. 410–11 Cartwright describes the habits of the white bear in Labrador, stating that the young are born in March, the parent bringing forth usually one at a time, sometimes two.

While on the coast of Labrador in the summers of 1860 and 1864, we gathered what facts we could as to the occurrence of this animal, publishing them in the Proceedings of the Boston Society of Natural History (Vol. x, 1866, 270), from which we take the following extract:

"At Square island, a locality situated between Belle isle and Domino harbor, two cubs were captured and taken to St. Johns, Newfoundland. At Domino harbor the skin of a bear killed during the preceding spring (1863) was obtained by one of our party. An intelligent hunter told me that the white bear was not unfrequently seen at Stag bay, near Roger's harbor, which is situated a little more than fifty miles south of Hopedale. One was killed there during the preceding winter (1863), and in the autumn their tracks were abundant. They were very shy, and could not be seen in the daytime. Further south they are much rarer. The last polar bear said to have been seen in the Strait of Belle isle was shot fifteen years ago (1849), at the settlement of Salmon bay.—*A. S. Packard.*

ZOOLOGICAL NEWS.—*General.*—A paper by Dr. Hans Gadow,

upon the cloaca and copulatory organs of the Amniota, was read at the Royal Society on March 25th. The derivation of the sphincter and copulatory muscles from skeletal and visceral muscles was followed up in the Sauropsida and Mammalia, and the modifications of the cloaca in the chief groups of the Amniota were described. In the latter respect Hatteria comes nearest to the Amphibia, and Chelonia is intermediate between ostriches and crocodiles on one hand, and the Monotremes on the other. The peritoneal canals are still functional in crocodiles and tortoises, but rudimentary in Hatteria. Muellerian ducts are present in young male crocodiles and wolffian ducts in young females. The conclusion is that the whole cloaca consists originally of (1) the proctodæum, or outermost epiblastic anal chamber; (2) the urodæum, or hypoblastic middle chamber or primitive cloaca; and (3) the coprodæum, or innermost cloacal chamber. The urodæum is oldest, and the ventral urinary bladder, as well as the dorsal anal sacs (tortoises), are differentiations of it. The bursa tabricii of birds, various hedonic glands and the copulatory organs are derived from the proctodæum. The resemblance of these organs favors the phylogenetic connection of the Mammalia with the Reptilia.

Porifera.—The keratose sponges of the Challenger expedition have been described by N. Poléjaeff, of Odessa. Though not deep-sea organisms, thirty-seven species were collected, of which twenty-one are new.

Vermes.—Volume XII of the Challenger reports is on the Annelida Polycheta, and occupies over 550 pages. No less than 220 species are described as new. In many cases the food has been examined, and it throws some light on the food resources of the abyssal depths. A large number of forms occur in the North Atlantic. The remarkable new genus Buskiella is confined to the abysses, 2000 fathoms and more, of the Atlantic, but most of the genera are cosmopolitan. A great number of species were found at Kerguelen, the land-locked bays of which were rich in annelids. Australia and Japan furnished some peculiar and novel forms, while the North Pacific yielded but few species, and the majority of those of the South Pacific came from the Straits of Magellan. The greatest number of species were taken at depths under ten fathoms. Between 100 and 200 fathoms the number of species was less than between ten and 100 fathoms, but there were more new forms, and below these depths most of the fewer species found were new. Between 600 and 1000 fathoms, fourteen species were found, all new except two; depths between 1000 and 1200 fathoms yielded four species, all new; while between 1200 and 1500 fathoms more than twenty species were collected, only five of which were before known, most of them from shallower waters. Below this all the species found were new. The majority of the deep-sea annelids are tube-dwellers.——Only twenty-

eight forms of Gephyrea were collected by the *Challenger*, with ten new species and no new genera. Forms before known as littoral were dredged from great depths. The strange male of *Bonellia viridis* with its curious segmental organs is figured.

Mollusca.—Some 500 species of lamellibranchs were collected by the *Challenger*. The greatest depth was marked by *Semele profundorum* and *Callocardia pacifica*, both found at 2900 fathoms in the North Pacific. The report by Mr. E. A. Smith forms Vol. XIII of the series.

Crustacea.—Mr. W. Faxon, in his revision of the Astacidæ (Mem. Mus. Comp. Anat., Vol. x. No. 4, Part 1), enumerates fifty-two species of Cambarus and fourteen of Astacus. These genera compose the sub-family Potamobiinæ. The Astacidæ of the southern hemisphere form the sub-family Parastacinæ. All the species of Cambarus, with one exception, are American; but the Astaci occupy three well-separated areas. (1) Western North America; (2) Europe; (3) Eastern Asia and Japan.—— The first part of M. F. E. Beddard's "Report on the Isopoda" of the Challenger expedition is occupied by the genus Serolis, of which sixteen species, nine of them new, were collected. Four of the species are deep-sea forms, while the remaining eighteen known kinds occur between five and 150 fathoms.——Fifty-seven species of Schizopoda, representing twenty-one genera, are described and figured by Prof. G. O. Sars in his report on the Schizopoda of the Challenger expedition. Forty-six of these are new. Prof. Sars regards these creatures as a sub-order of Decapoda, and recognizes four families: Lophogastridæ, Eucopiidæ, Euphausiidæ and Mysidæ. Nine species of Gnathophausia are described, one of them six inches in length. Twenty-three new species of Euphausiidæ are described, and post-embryonal stages of several genera are figured, showing that they are hatched as true Nauplii.

Birds.—One would believe that the habits of the European cuckoo are by this time well known, but Mr. Seebohm, in his History of British Birds, throws doubt on this, since he states that the usually received idea that the young cuckoo, soon after it is hatched, ejects the eggs or young of its foster parents, does not rest on a secure foundation. *Nature* puts against this the observations of Mr. J. Hancock, as recorded in the Natural History Transactions of Northumberland (1866). On January 17th, 1884, the nest of a hedge sparrow or hedge accentor, containing four eggs of the species, and one cuckoo's egg, was discovered. On the 27th the cuckoo's egg and two of the accentor's eggs were hatched. On the 28th, at 10.30 A. M., the cuckoo put one of the unhatched eggs out of the nest, and half an hour later it threw out one of the young accentors, the mother looking on quite calmly the while. At 1 it pushed out the second egg, and at

3.30 got rid of the second accentor. In this case poetical retribution was wrought, for while one of the turned-out accentors was placed in a white-throat's nest, and cared for by its foster parents, the young cuckoo was about a week afterwards found dead at the bottom of the nest.

Mammalia.—Dr. C. H. Merriam has reported to *Science* the discovery of an Aplodontia, show'tl or mountain beaver, which he believes to be sufficiently distinct from the ordinary form to take rank as a new species. Eight examples were taken in Placer county, Cal. The skull of this *A. major* is much larger and heavier than that of *A. rufa*, the occipital crest more highly developed, and the zygomatic arches more strongly convex. There are also differences in the color and pelage. A fœtal pigmy sperm whale (*Kogia breviceps*) has been received by the Smithsonian Institution. It is now proved that this species breeds in May.

EMBRYOLOGY.[1]

THE EARLY DEVELOPMENT OF JULUS TERRESTRIS.[2]—The eggs of *J. terrestris* are oval, white and covered by a thick chitinous chorion; the nucleus is embedded in a mass of protoplasm in the center of the egg. This central mass of protoplasm is irregular in shape, but its long axis corresponds with that of the egg. From it anastomosing processes radiate in all directions, forming a network throughout the egg, in the meshes of which the yolk-spherules are contained. The nucleus is not a distinct vesicle, but its position is marked by chromatin granules, and there is no nucleolus.

On the second day the nucleus and central mass divide into two parts, but this division is not complete, the two resulting masses with their nuclei remaining connected by a network of protoplasm. The two segments then again divide in the same incomplete manner, so that there are now four segments connected together. On the third day the formation of the blastoderm begins, some of the segmentation masses making their appearance on the outside of the ovum at different points, so that the development of Julus resembles that of Geophilus as worked out by Sograf. The cells in the interior of the yolk are the direct descendants of the first segmentation masses, and constitute the hypoblast.

The fate of the hypoblast cells is various; some are employed in the formation of the mesoblastic keel, that is, in the formation of the splanchnic and somatic mesoblast. Another part gives rise to the hypoblast of the mesenteron, and a third portion remains in the yolk after the mesenteron is formed, and gives rise to mesoblast cells which are employed in the formation of various muscles and the circulatory system.

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] F. G. Heathcote, M.A. Proc. Roy. Soc. London, Vol. XL, No. 242, pp. 73–76. (Read Jan. 21, 1886.)

With regard to the retention of the primitive union of the cells of the ovum until this stage, nothing of the sort has been described before, except by Sedgwick in Peripatus. The most important part, it seems to me, is not the connection of cell to cell, but of layer to layer by means of processes of the cells.

About the middle of the fourth day several of the hypoblast cells approach the epiblast in the middle line of what will eventually be the ventral surface of the embryo. This is the beginning of a mesoblastic keel such as Balfour described for Agalena.

The epiblast cells in the ventral middle line, after altering their shape, increase by division and take a considerable share in the formation of the keel. The hypoblast cells below them also increase, and on the fifth day the mesoblastic keel is complete, in the formation of which both epiblast and hypoblast have taken part. The keel is still present on the sixth day, but the cells composing it are becoming elongated in a plane parallel to its surface. They then spread out to form two definite splanchnic and somatic layers of the mesoblast below the epiblast. These two layers are connected. The keel disappears on the seventh and eighth days, and on the ventral surface the epiblast cells assume a columnar form, thus giving rise to the ventral plate.

The mesoblast now becomes thicker on each side of the median line, both layers being concerned in this thickening, where they become indistinguishable. Outside the thickenings, that is, farther away from the middle line, the two layers are closely applied to each other and to the epiblast, as before. It thus results that the mesoblast is mainly arranged in two parallel longitudinal bands along the ventral side, these bands being connected across the middle line by a thin portion consisting of a single layer.

These bands now begin to be segmented into mesoblastic somites from before backwards, their position corresponding with that of the future segments of the body. There are at first eight somites, corresponding with the eight segments of the embryo when hatched. These somites are at first solid; afterwards a cavity appears in them.

Early on the ninth day the stomodæum is formed as an invagination of the epiblast near one end of the ventral surface. Shortly after the formation of the stomodæum the proctodæum appears as a shallow somewhat wide invagination of the other end of the ventral surface.

The body segments now become more apparent, each being marked by a deep transverse furrow in the epiblast. The hypoblast cells are still present within the yolk, but are gradually becoming collected in the median line, just below the mesoblastic bands. The stomodæum and proctodæum become more deeply invaginated, extending a considerable distance into the yolk, and at the

same time the hypoblast cells begin to form the mesenteron, arranging themselves around a central lumen.

On the tenth day the ventral flexure is formed by a deepening of the transverse furrow between the seventh and eighth segments. As this furrow deepens and the embryo increases in size, the last segment grows in length. At the same time the embryo curves round toward the ventral surface, the end segment being bent round against the head. The eighth segment is longer than the others except the head. Even as late as the twelfth day, when the nervous system is far developed in other parts of the body, in the eighth segment the tissues are imperfectly differentiated, the nerve cords not showing any ganglia, but lying on the epiblast and not quite separated from it. At a later period of development the anal segment is constricted off from the eighth, while from the anterior part of the latter, the additional segments formed in the course of development are derived. These additional segments are therefore intercalated between the seventh and ninth.

Just before the appearance of the ventral flexure the embryo develops a cuticular envelope over the whole surface of the body. This is the so-called amnion of Newport. Just before the formation of the ventral flexure the nervous system is formed. The first traces of this consist in a thickening of the epiblast on each side of the middle line; this is soon followed by the formation of a shallow furrow between the thickened parts; this longitudinal furrow corresponds with that described by Metschnikoff in Strongylosoma.

The bilobed cerebral ganglia are formed first, and the nerve cords are formed from before backwards, a pair of ganglia being present for each segment except the last. The posterior portion of the nerve cords is completed at a considerably later stage of development. The nerve cords are widely separated, but are connected by a thin median portion. In later embryonic life they are closely approached to one another, and almost form one cord.

On the eleventh day the embryo has increased considerably in size. The ventral flexure is complete, and the animal lies with the long end segment folded closely against the rest of the body, the end of the tail being against the stomodæum. The nervous system is now completely separated from the epiblast, and the epiblast has assumed the adult form. It now separates a second membrane like that which is formed on the tenth day.

The splanchnic layer of mesoblast covers the mesenteron, the stomodæum and proctodæum.

Within the yolk, which is still present in great quantity in the body-cavity, there are present a number of hypoblast cells. These, as has already been mentioned, give rise to the circulatory system and to various muscles. They may, therefore, be now con-

sidered as mesoblastic cells which have been directly derived from the hypoblast.

On the twelfth day the Malpighian tubes are formed as blind outgrowths of the proctodæum, the nervous system is further developed, and the first rudiments of the appendages begin to appear. Late on this day the animal is hatched with only the rudiments of its appendages.

An investigation of the development of Geophilus by Sograf[1] shows that the early cleavage of the egg of Chilopods is very similar, not only that, but even the formation of the mesoblastic bands and cœlomic cavity is similar. Great numbers of cells also remain in the yolk in this form until a late period and apparently migrate outwards, and may possibly take a share in forming certain mesoblastic structures. There is, however, no evidence to show that the yolk lies immediately within the body-cavity in either Geophilus or Lithobius, but rather within the mesenteron, so that in this respect the Chilopods differ pretty widely in their development from the Diplopods, as described by Heathcote. It may be that the splanchnic mesoblast may indirectly acquire accessions of cellular elements from the underlying walls of the mesenteron, even in the Chilopods, but of this there is no very clear evidence, except in the case of one of Sograf's figures. The Malpighian tubes develop in the same manner in Geophilus as in Julus; and, while there is no clearly defined anal segment developed as in the latter, the somites are formed from behind forwards between the first-formed segments and the terminal section of the body, where the proctodæum is invaginated. The wall of the mesenteron is the last structure from which the yolk-spherules disappear in the Chilopods, and finally the lumen of the mesenteron appears surrounded by a second nearly homogeneous investment of yolk which lies within the hypoblastic wall of the mesenteron, and in which free multipolar cells are embedded. There occurs a dehiscence of cells into the cœlom from the splanchnic mesoblast investing the mesenteron. These free cells represent blood cells. The process is somewhat analogous to that observed in embryo fishes, in which blood cells are freed from the periblast of the yolk, the periblast, though undoubtedly occupying the position of the hypoblast, has, on account of the peculiar way in which the yolk is finally excluded from the ventral side of the intestine, taken up the position of a splanchnopleure in relation to the somatopleure, which covers not only the viscera but also the yolk, so that the latter in fishes may be considered to be intraäbdominal, since the periblast or what represents the splanchnopleure, at least in part, is in many cases a transitory structure, leaving no trace of itself in later embryonic life. Were the lumen of the intestine, however, to originate in

[1] In contributions from the Laboratory of the Zoölog. Museum in Moscow, Vol. II, 4to, 1883. (In Russian.)

the same way in fishes as in Myriopods, viz., as a direct canalicular vacuolization of the yolk passing through its central longitudinal diameter, the periblast would doubtless then represent the hypoblast or what it did in very primitive fish-like forms, while externally it would have been covered by a true splanchnopleure which had been developed in advance of the permanent hypoblast of the mesenteron, though the latter had been primarily derived from the primitive hypoblast.

The eggs of the Myriapoda, it is to be remembered, represent a very peculiar type, that is, they at first have the germinal matter concentrated in the center, but as development proceeds the germinal matter, after segmentation into a number of cells, is repelled centrifugally or to the outer surface of the ovum. The primary segmentation therefore occurs in the center of the egg and not at one side or superficially until some progress in segmentation has been made at the center of the egg. This probably characteristic mode of development seems to distinguish, in a measure, the Myriapoda from other Arthropoda, since in no other arthropodous form does the vitellus so constantly occupy a superficial position and so completely invest the first segmentation cells, which are then aggregated in a cluster at the center of the egg.

The Development of Agelena nævia.[1]—In the memoir, the place of publication of which is here cited, William A. Locy has very carefully worked out the development of the spider (Agelena), and obtained a number of new and important morphological results. He finds that there is at first a peripheral layer of protoplasm present, and that the nucleus of the first segmentation is central and imbedded in plasma. This first nucleus subdivides and gives rise to new nuclei, each invested by plasma. These migrate to the periphery of the egg and appropriate the peripheral layer of protoplasm or "blastema." In this way a hollow blastoderm is formed. Just before the primitive cumulus is formed a depression appears at the point where the latter develops, and it appeared not improbable that this depression represents the first portion of the blastoderm of the spider's egg which becomes invaginated. Later, and about 80° from the primitive cumulus, a second thickening appears in the blastoderm; this second thickening spreads rapidly and becomes shield-shaped. Between the two the intervening blastoderm then becomes thicker, thus leading to the development of the ventral plate.

The protozonites or first indications of somites are then formed from the cephalic and caudal plates. Two somites arise from the former and they bear the cheliceræ and pedipalpi; the other somites develop from the caudal plate, and give rise to the ambulatory and rudimentary pairs of appendages. The embryo still presents a transversely banded appearance in the third as in

[1] Bull. Mus. Comp. Zoölogy, XII, No. 3, 1886, pp. 63–103, Pls. 12.

the preceding stage. Sections show that the cavities of the limbs are prolongations of the cavities of the corresponding mesodermic somites. The nervous system at first consists of two rows of ganglia, one to each somite; these are widely separated in the middle line, except in the head and tail lobes, where those of opposite sides are fused. The stomodæum arises as an invagination between the ganglionic thickenings of the cheliceral somites, and immediately below the ventral margin of the cephalic plate.

About the time that the ventral flexure appears, or when the embryo becomes folded upon itself, the proctodæum, heart, lungs, trachea, spinning glands and muscles develop. The cheliceræ and pedipalpi appear as postoral structures, but in the course of further development they appear as preoral appendages. At an early stage the proctodæum is enlarged by the outgrowth of its dorsal wall; from this diverticulum the so-called stercoral pocket of the adult is formed. The lateral nerve cords are finally approximated in the middle line, and the posterior or abdominal portion of the nervous system degenerates. The poison glands appear as groups of enlarged cells at the bases of the cheliceræ. The spinning glands develop from the ectoderm in the anal region on the ventral side of the proctodæum. The lungs arise as infoldings from a large oval pair of masses of cells, the nuclei of which are arranged in parallel lines. From these cells the lamallæ of the lungs are formed. The heart remains open below for a time, communicating freely with the yolk. The aorta, at a later period, is constricted off from the mesenteron. At least two pairs of the provisional appendages on the abdomen are modified into the spinning mammillæ. The remnant of the upwardly flexed tail persists for some time as a postanal knob; its tip represents the morphological end of the body.

The eyes are developed as invaginations of the ectoderm (hypodermis). The retinal involution becomes constricted off from the ectoderm entirely, and then lies just below that portion of the hypodermis which afterwards becomes the vitreous body. In a concave depression, on the surface of the latter, the lens arises as a lenticular thickening of the cuticula. The mode in which the light traverses the eye is essentially similar to the method in which the light reaches the percipient elements of the retina in the vertebrate eye.

Embryology of Armadillos.—It is a belief among the people of South America that armadillos bring forth only male young. Dr. von Ihring, of San Paolo, communicates to *Cosmos* some important observations he has made on this and other points in the history of the development of the armadillo *Praöpus hybridus*. He states that all the fœtuses taken from two females presented the external characters of males only. He also states that several fœtuses—six or more—are enclosed in a single chorion,

which is surrounded by as many zonary placentæ as there are fœtuses, the placentæ not, however, forming perfect zones. He finds the ungual phalanges at this period to differ entirely from that of the adult. Instead of being long and claw-shaped, they are wide and hoof-shaped, with a trilobate margin, as in the extinct genus Gyptodon. This is highly interesting as exhibiting the law of acceleration modifying that of heredity. The sexual characters are probably like those of the hyænas, in that the female fœtus has a clitoris so large as to give her a close resemblance to the male.—*E. D. Cope.*

PSYCHOLOGY.

GAMBETTA'S BRAIN.—The *Revue* recently (November 21st, 1885) gave the weight of Gambetta's brain, according to M. A. Bloch. This weight, which was remarkably light (1160 grammes), evidently ought to be considered as an entirely secondary element in a proper estimate of the diverse qualities of the organ. At a recent session of the Society of Anthropology (March 18) Professor Mathias Duval communicated a very interesting report in which he brought out and gave their due value to certain structural details of this brain—to certain characteristic elements which must be regarded as far outweighing the simple consideration of the gross weight of the organ. Compared with the brains of individuals known to have been possessed of but little intelligence, and representing types of reduction of the third frontal convolution, the brain of Gambetta, besides other peculiarities, shows a type of extreme development of that convolution. This development is such that not only are the secondary convolutions more numerous and more complicated than those of ordinary brains, but, besides this, the "cape" is double.

This development is evidently in favor of the localization discovered by Broca, who held that the third frontal convolution was the seat of speech. M. Mathias Duval has also pointed out the two following peculiarities, the significance of which he has not been able to determine.

(1) The right quadrilateral lobule is very complicated, and is divided into two parts by a sulcus which starts from the occipital fissure. The lower of these two parts is subdivided into many secondary convolutions by the presence of a fissure with numerous branches arranged in star-like patterns.

(2) The occipital lobe is notably reduced, especially upon the right side.

M. Mathias Duval thinks therefore that Gambetta's brain should be considered refined (*beau*)—although the expression does not appear to him scientific—in the sense that it preserves, especially in the frontal region, in spite of the complication of its folds, a regularity which may be called schematic.—*Revue Scientifique, April 3d, 1886, p. 444.*

MEMORY IN THE HUMBLE BEE.—The author removed a nest containing numerous individuals of one of the common humble bees (*Bombus terrestris*) from its original location, and carried it to his residence, about three miles distant. He further carefully watched the place for some time after having captured all those that had flown to the defence of their nest, and secured, it was believed, the entire colony. These he imprisoned for several hours in a wide-mouthed bottle, and safely reunited them in their new home. At his house he placed the nest, with its inhabitants, near a window, and after they had become quieted, made a small entrance. Immediately they began to fly out, and in doing so must have observed their surroundings, for in a short time they one by one returned. The following night, however, there was a severe storm, and while the inhabitants of the forty other colonies near it, that had not become accustomed to their surroundings, were not in the least troubled, these bees escaped, and hid themselves somewhere without during the storm. Upon searching for them early the next morning, the queen was found dead upon the ground, while fifty or sixty of the workers were seen flying about the house. From time to time one or another—probably those which had flown out of the entrance the day before—found the opening and returned into their nest, while the remainder after flying about for several hours gradually disappeared, till not one was left. As it was supposed that they had in all probability returned to their previous nest, the place was visited in the afternoon, where, sure enough, at least fifty individuals were found. They had thus, it will be seen, distinctly remembered it, and after they had sought in vain to find entrance to their new home, they had depended upon their wonderful sense of locality, and returned thither.

A similar instance was observed with another nest, which had been removed a distance of nearly five miles, and in which the same care had been exercised to capture all the individuals. In unskillfully handling the box containing the nest and bees, in its new location, about thirty of the workers escaped, and flew through the open window. After flying for a long time about the house, as though in search of their comrades, they likewise disappeared and returned to their original nest, and again established themselves, as was afterwards ascertained.

It was frequently observed that, when nests have been removed but a short distance, the workers during the first few days after their change, would fly swiftly in the direction of their old nest, when, discovering their mistake, they would change their course, and go to their new home. It seemed evident that these little creatures, through some mental process or other, thus discovered their changed circumstances.

In order to test further this remarkable sense of locality, the author marked a number of individuals with oil colors, and carried

them, enclosed in wooden cases, a distance of eight or nine miles, when he allowed them to escape. Very many of them, though not all, found their way back to their nests, and as a rule reached home sooner than the author did himself.

The author noticed that at his summer residence, where he had kept numerous hives of these bees, the following spring many individuals appeared, and seemed to be searching for their previous nests; but he was unable to determine whether they were individuals of the previous broods or not. Towards the close of July, 1884, he obtained three nests of *Bombus mastrucatus*, a large species only found in the mountains, and especially the higher regions, and carried them to his residence in the city, where he placed them in a window of the second story. The house was enclosed by high buildings, with no garden attached, and yet they returned readily and directly from their excursions to their nests.

They throve, and by the first of October had increased to considerable numbers. By the middle of October they wholly disappeared; but in the early part of the following April, individuals of this species were observed flying about the window, and as soon as they found an entrance, sought the remains of their old nests, and took up their abode. They remained for a while, when their nest was accidentally injured, and they left. Nothing more was seen of them till after the author's return from his summer vacation, in the middle of September, when a single female of this species made its appearance. In their inability to obtain an entrance through the closed window, they had evidently built a new nest in the vicinity, and reared their broods.

These circumstances indicate that the intellectual powers of the humble bee are not as slight as we have been accustomed to believe. Here in this case, from October to April—a period of six months—had these bees remained dormant in the ground, or hidden in some crevice, and, upon regaining their activity, had not only remembered the place where they were, but had sought and found, despite the many difficulties, their last year's nest. That these individuals were from last year's brood, there was no doubt, as throughout the province the species nowhere else occurs, peculiar as it is to elevated and mountainous regions.

The foregoing is from *Science*, April 9th, 1886 (translated from *Kosmos*), but we do not agree with the statement that the brain of the bee is simple; on the contrary it is only less complex than that of a fish.

THE VISION OF BIRDS.—I have been exceedingly interested, while watching the wrens, robins, and blue-birds at the time they are rearing their young broods, to note the celerity of their movements and the evident acuteness of their vision. They are able to see an insect much further than a person can distinguish one, and fly as straight as an arrow to the minute object when it is from fifteen to thirty feet distant. They seem to make no mistakes, but always

to secure the coveted prey. I have often seen these birds dart down *into the grass* from those heights and seize an insect with such precision that it must have been plainly visible from where the start was made. This would indicate that they possess a faculty of sight, developed by ages of practice, altogether above that of the human race, and most useful in their struggle for existence. But the late Robert Kennicott (quoted by Baird, Brewer and Ridgway in their great work on the Birds of North America) states that a pair of a wrens will capture 1000 insects per day during the breeding season, and this fact of itself would indicate the sharpest vision and wonderful celerity of movement.—*Charles Aldrich, Webster City, Iowa, June 1st, 1886.*

ANTHROPOLOGY.[1]

THE DAVENPORT ACADEMY has just issued Vol. IV of its Proceedings, nearly the whole of which is occupied with anthropology. The papers of Dr. Hoffman and Mr. Holmes have been some months in print and have been previously noticed. An appendix of nearly one hundred pages is by the president of the academy, and entitled "Elephant pipes and inscribed tablets in the museum of the Academy of Natural Sciences, Davenport, Iowa." The contents of this appendix may be tabulated as follows:

1. A defence of the separate nationality of the Mound-builders against the theory of their identity with modern Indians.
2. A defence of the genuineness of the three inscribed tablets and two elephant pipes in the museum of the Academy, especially against the statements of Mr. Henshaw in his paper published in the second annual report of the Bureau of Ethnology and the endorsement of the director of the bureau.
3. An argument against centralization of ethnological work in the Smithsonian Institution and the Bureau of Ethnology.
4. A series of letters from friends of the Davenport Academy in sympathy with a former vindication.
5. Extracts from scientific journals in relation to the same subject.

Whether the Mound-builders were succeeded in the Mississippi valley by their immediate descendants, the Indians living there when the whites made their appearance three centuries and more ago, is an open question, though some archæologists have declared the argument closed. Dr. Carr, Dr. Brinton, the director and the archæologist of the Bureau of Ethnology, and many others are in favor of the identity. Squier and Davis, President Putnam and many other eminent archæologists hold the contrary view, maintaining that the Mound-builders exhibited traits of civilization which set them far above their modern successors on the same soil. The appendix to the Davenport Proceedings is an able summary of the arguments in favor of the higher civilization of the Mound-builders. It seems to us that a comprehensive review of what can be said for and against this theory by some judicial mind would be exceedingly timely.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

Upon the second point we can throw no additional light. The Davenport Academy is one of the most thriving State associations for research and collection of material. In some particulars the museum vies even with that of the Smithsonian Institution. There are in all this vast treasure five objects which run the whole gamut of reputation, from that of base fraud to the highest credibility. President Putnam gives the history of their acquisition as follows:

a. The discovery of two inscribed tablets in Mound 3, on Cook's farm, near Davenport, by Jacob Gass, L. H. Willrodt and H. S. Stolzenau, with five other persons, Jan. 10, 1877.

b. The discovery of another tablet, Jan. 30, 1878, in Mound 11, on Cook's farm, by Jacob Gass, John Hume and Charles E. Harrison.

c. The discovery, in March, 1880, of an elephant pipe in a mound on Hass' farm, in Louisa county, Iowa, by A. Blumer, Jacob Gass and F. Hass.

d. The obtaining of an elephant pipe by Jacob Gass from a farmer in Louisa county, Iowa, who found it on his farm while planting corn.

In reply to the assertion that these pieces are not genuine, Mr. Putnam enters the most eloquent protest, backed up by Farquharson, Pratt and J. D. Putnam, who were familiar both with the finders and the finds. President Putnam commits himself to belief in the contemporaneity of man and the mastodon in America, invoking the testimony of Koch, Dickson, Pourtales, Dowler, Winslow, Whitney, Cleu, Hilgard and Fontaine. This contemporaneity is again a subject open to discussion, and no doubt it will receive the attention which it deserves.

The third part of President Putnam's argument, in which the Smithsonian Institution and the Bureau of Ethnology are held to be antagonistic to local societies of our country, ought to have been omitted. Ninety-one pages of the volume containing Mr. Putnam's argument were contributed by Dr. Hoffmann and Mr. Holmes of the Bureau of Ethnology. On page IV it is distinctly stated that Dr. Hoffman and the Bureau of Ethnology furnished all the illustrations for these papers without expense to the academy. On p. 245 we are told that "the special thanks of the academy were tendered to Major Powell for his courtesy in lecturing, free of charge, for its benefit."

The writer of this note, long before his connection with the National Museum, was familiar with the intense desire of Professor Baird to foster local scientific organizations. He also, at Major Powell's request, sat for several days on a commission to nominate anthropological societies and students throughout the world to receive all the publications of his bureau, in order to place them where they would do the most good. It would be an irreparable loss to anthropological science if by any means this bureau should be disestablished before Powell, Pilling, Mallery, Thomas, Henshaw, Dorsey, Gatschet, Cushing, the Mindeleffs, Hoffman, Yarrow, Boas, Murdoch shall have finished the

great work which each has undertaken, and any one of which would be far too burdensome for any scientific association in America to carry.

VOCABULARY OF ARCHERY.—In a former number of the NATURALIST Mr. John Murdoch kindly furnished us with a vocabulary of the harpoon. We give below a vocabulary of archery, hoping that all who are in sympathy with us in establishing accurate nomenclature for the various branches of anthropology will aid in adopting these terms, or at least will state their objections if they have any. No claim whatever is made to originality in most of the terms. Dr. John Evans, the Encyclopædia Britannica, Professor Morse, Mr. Murdoch, Hansard and others have been freely consulted. The list of words given below includes the bow, the arrow and the arrow-maker's outfit. No discrimination is made between ancient and modern archery, as it is designed to include the whole life-history of this species of human activity in the same manner that a zoölogist would monograph species of animals:

ARCHER, old French *archier*, Latin *arcarius*, from *arcus*, a bow, one who shoots with a bow; whence archery, shooting with the bow.

ARM-GUARD. The Japanese, in releasing, revolve the bow in the left hand; a guard is worn on the outer side of the forearm to catch the blow of the string.

ARROW, a missile shot from a bow. The possible parts are the head, barb-piece, foreshaft, shaft or stele, feathering, nock, and seizings.

ARROW CEMENT, substance used in fastening the arrow-head to the shaft. A few tribes use glue or cement in making the sinew-backed bow.

ARROW-HEAD, the part of an arrow designed to produce a wound. The parts of the primitive stone arrow-head are the tip or apex, faces, sides, base, shank or tang, and facets.

ARROW-STRAIGHTENER, a piece of bone, wood or ivory with a perforation to serve as a wrench in straightening arrow-shafts, barbs, etc.

BACK (side), the part of the bow away from the archer.

BACKED, a bow is backed when along the outside are fastened strips of wood, sinew or cord to increase the elasticity.

BALDRIC, the strap supporting a quiver or sheath, being worn over one shoulder, across the breast and under the opposite arm; generally much ornamented.

BARB-PIECE, the piece of ivory, &c., on some arrows attached to the true head and having barbs on the sides. This should be carefully discriminated from the foreshaft, which has another function altogether.

BASE of an arrow-head, the portion which fits into the shaft.

BELLY (inside), the part of a bow toward the archer, usually rounded.

BOW, an elastic weapon for casting an arrow from a string. (See self-bow, compound bow, backed bow, grafted bow.)

BOW-CASE, a long bag of wood, leather or cloth, in which the bow is kept when not in use.

BOW-STAVE, the bow in a rough state. Bow-staves were an important item of commerce prior to the use of gunpowder.

BOW-SHOT, the distance to which an arrow flies from a bow.

BOWSTRING, the string used in discharging a bow. The substances used, the method of treatment and of nocking are important to notice.

BOW-WOOD, the substances used for bows, generally wood, but horn, antler, bone and metal have been employed.

BOWYER, a maker of bows.

BRACER (wrist-guard), a contrivance for protecting the archer's wrist from being galled by his bowstring.

BRACING (stringing), bending the bow and putting the eye of the string in the upper nock preparatory to shooting. The different methods of bracing throughout the world form an interesting study.

BUTTS, pyramidal banks of earth used formerly for targets.

BUTT-SHAFT, a blunt arrow for shooting at a butt, the ancient style of target.

CHIPPER, the pointed implement of bone, antler, &c., used for shaping flint arrow-heads, spear-heads, &c.

COCK-FEATHER, that feather of an arrow which is uppermost when the bow is drawn.

COMPOUND BOW, made of two or more pieces of wood, bone, horn, antler, lashed or riveted together.

EYE, the loop of a bowstring which passes over the upper nock in bracing.

FACES, the broad, flattened portions of an arrow-head.

FACETS, the little surfaces left by chipping out a stone arrow-head.

FEATHERING, the strips of feather at the butt of an arrow, including the method of seizing or fastening.

FLAKING HAMMER, called also hammer stone, a stone used for knocking off flakes in making flint arrow-heads, &c.

FLETCHER, an arrow-maker, akin to *fleche*.

FOOTING, a piece of wood inserted in the shaftment of an arrow at the nock.

FORESHAFT, a piece of hard wood, bone, ivory, antler, &c., at the front end of an arrow to give weight and to serve for the attachment of the head.

GRAFTED BOW, a species of compound bow formed of two pieces joined together at the handle.

GRIP, the part of a bow grasped in the hand. The same term should be applied to the corresponding part of swords, daggers, &c., where it is differentiated in any manner.

GUARD (wrist-guard), a shield of leather or other substance fastened to the wrist of the left hand to prevent injury from the bowstring (see bracer).

HORN, the end of a bow when made of horn.

LIMBS, the part of a bow above and below the handle or grip.

NOCK, properly the notch in the horn of a bow, but applied also to the whole of that part on which the string is fastened. Upper nock, the one held upward in bracing. Lower nock, the one on the ground in bracing. Also the notch in the end of an arrow.

NOCKING, placing the arrow on the string preparatory to shooting.

NOCKING-POINT, that place on a bowstring where the nock of the arrow is to be fitted, often whipped with silk.

NOOSE, the end of a string which occupies the lower horn of a bow.

OVER-ARROWS, those shot directly over the center of the mark and beyond the target.

OVERHAND, shooting overhand is to shoot at the mark over the bow-hand, when the head of the arrow is drawn inside the bow.

PACKING, of leather, fish-skin or other soft substance used in binding the nocks and the grip of bows.

PILE, the head of an archery arrow; any arrow-head may bear the same name, in which we may have a one-pile, two-pile, three-pile arrow, &c.

PITCHING-TOOL, or knapping-tool, a column of antler or other hard substance used between the hammer and the core in knocking off flakes of stone.

RELEASE, letting go the bowstring in shooting. Professor E. S. Morse characterizes the various releases as follows:

1. Primary release, thumb and first joint of forefinger pinching the arrow nock.
2. Secondary, thumb and second joint of forefinger, middle finger also on string.
3. Tertiary, thumb and three fingers on the string.
4. Mediterranean, fore and middle finger, thumb not used.
5. Mongolian, thumb on string, with or without thumb-ring.

RIBAND, a term applied to the stripes painted on arrow-shafts, generally around the shaftment. These ribands have been called clan-marks, owner-marks, game tallies, etc.

SEFIN (see thumb-ring).

SELF-BOW (simple), made of a single piece of wood or other material.

SHAFT, anciently an arrow, but strictly the portion behind the head, and in a foreshafted arrow the lighter portion behind the foreshaft.

SHAFT-GROOVES, furrow cuts along an arrow-shaft from the head backward; they have been called blood-grooves and lightning-grooves, but these names are objectionable as involving theories.

SHAFTMENT, the part of an arrow on which the feathering is laid.

SHANK, the part of an arrow-head corresponding to the tang of the sword-blade.

SHORT-ARROWS, those which fall short of the mark.

SIDES, of an arrow-head, the sharpened portions between the apex and the base, also called the edges.

SINEW-BACKED BOW, one whose elasticity is increased by the use of sinew along the back, either in a cable of twine, as among the Eskimos, or laid on solid by means of glue, as with many tribes in Western United States.

SLEIGHT, the facility with which an archer releases his bowstring.

STELE (stale, shaft), the wooden part of an arrow, an arrow without feather or head.

TARGET, a disk of straw covered with canvas, on which are painted concentric rings, used in archery as a mark in lieu of the ancient butt.

THUMB-RING, a ring worn on the thumb in archery by those peoples that use the Mongolian release; called sefin by the Persians.

TIP, a term applied to the sharp apex of an arrow-head.

TRAJECTORY, the curve which an arrow describes in space, may be flat, high, &c.

WEIGHT, of a bow, the number of pounds required to draw a bow until the arrow may stand between the string and the belly, ascertained by suspending the bow at its grip and drawing with a spring scale.

WHIPPING (seizing, serving), wrapping any part of a bow or arrow with cord or sinew regularly laid on.

WIDE-ARROWS, those shot to the right or the left of the mark.

MICROSCOPY.[1]

A STAINING DISH.—A convenient form of staining dish has hitherto been a desideratum; at my request the Educational Supply Co., at 6 Hamilton place, Boston, has undertaken to supply this desideratum. The new dish, shown of the natural size in the cut, is made of clear glass with polished surfaces; it is sufficiently deep to hold a considerable quantity of fluid, while the curves inside are such that although large sections lie nearly flat, yet

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoölogy, Cambridge, Mass.

when very little fluid is used it gathers into the center. The dishes, owing to their vertical sides, are readily stacked, while

the bevel is wide enough for a label, which can be easily seen both when the dishes are stacked and as they set upon the table singly. They are sold at $2.50 per dozen.—*Charles S. Minot.*

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SCIENTIFIC NEWS.[1]

— The new museum building of Columbia College, New York, devotes its first floor to chemistry, the second to mineralogy and metallurgy, the third to archæology and geological conference, the fourth to engineering and museums, the fifth to geology and palæontology. The building runs from 49th to 50th street, forty feet wide, with lecture-rooms adjoining each museum. The library has been arranged and catalogued, and is lighted by electricity. The astronomical observatory over the library, in charge of Professor J. K. Rees, has been equipped with telegraphic apparatus and a thirteen-inch equatorial telescope, costing $20,000, given by Louis M. Rutherford, which is used for lunar researches. The herbarium has extensive rooms, and is one of the largest and most valuable in the country. The geological museum, under Dr. J. S. Newberry, has been rearranged and provided with new cases, and is now displayed at the best advantage. The table cases are ten by four feet in size, and completely filled with mineral ores and products, making the most varied collection of the kind extant. Fifteen wall cases are filled with minerals and building stones. The palæontological collection is arranged in twelve table and sixteen wall cases to the best advantage for instruction. Here also cases containing numerous specimens of rocks and the minerals which make rock, as auxiliary to the study of lithology. There is a large collection of animals illustrative of the different groups bearing on the study of palæontology. Among the recent additions are specimens of fossil Saurians from the Jurassic rocks of Würtemberg, representing the Ichthyosaurians and Teleosaurians; a fine specimen of the cave-bear, etc.

[1] Edited by Wm. Hosea Ballou, 265 Broadway, New York.

— There is some hope of having a Division of Ornithology and Mammalogy created in the Department of Agriculture. Professor Riley and Dr. Merriam recently appeared before the Senate sub-committee on appropriations having in charge the agricultural appropriation bill, and urged an amendment to the House bill creating such a division and appropriating $15,000 therefor. Our readers are aware that ornithological work was begun last year under the Division of Entomology. It was added to Riley's others duties against his wish, and he deserves the thanks of ornithologists for carrying out the wishes of the Ornithological Union in appointments made under him. He realizes that there is much in economic ornithology which has no bearing on entomology, and if the new division is created, Professor Riley and Dr. Merriam have arranged that the former will take charge of that part of the work bearing on the food-habits of birds in relation to insects.

— The seeming anomaly is presented, by the excessive demand for furs, of the extermination of large species and the increase of smaller ones. This is obviously due to the fact that large animals require great space to roam over, while the smaller ones need but little territory, and propagate with rapidity, follow immigration and increase with the population in farm districts. Further, the increase of population diminishes the territory of large species, making them more accessible and increases the domain and support of the smaller animals. The annual extermination of the beaver is about 200,000 animals, of the muskrat about 2,150,000, and yet there is no perceptible diminution in their numbers. The grizzly and polar bears and Shetland seal are nearly exterminated. Of the last named only 200 skins were secured last year, and the price of cloaks made from them advanced to $1200.

— The American causeway, or basaltic columns, at Orange, New Jersey, is the largest yet exposed. The columns are compressed into a mass 750 feet long and 100 feet high, covering fourteen acres. The generality stand vertically, but some lie in a horizontal plane and others radiate from a common center. Interiorly they are a dark-blue color, covered with an incrustation of dust particles. They range in shape from prisms to octagons, the pentagons predominating. Underneath is an enormous deposit of red sandstone. The columns are being quarried for building blocks and micodons.

— Candidates for apprenticeships in the United States Navy must come within the following measurements:

Age.	*Weight.*	*Height.*	*Chest.*
14 to 15	70 lbs.	57 inches.	26 inches.
15 " 16	80 "	59 "	27 "
16 " 17	90 "	61 "	28 "
17 " 18	100 "	62 "	29 "

— Thos. Edwards, the Banff naturalist, so well known from Smiles' biography, is dead. Since the publication of Smiles' work he has enjoyed a pension of £50 per annum, and latterly he has been curator of Banff Museum.

— A dromedary in Central park, N. Y., gave birth, on May 17, to a calf weighing 105 pounds. This is said to be the third birth of the kind in the United States.

— The morning glory, natural grasses and other species of land life rapidly take the place of aquatic plants in the vast areas of drained lands in sub-tropical Florida.

— The Chicago Academy of Sciences has deposited its collection in commodious quarters at the Exposition building on the lake front.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington, May 15. — Communication: Dr. C. Hart Merriam, habits of the short-tailed shrew (Blarina).

May 29.—Communications: Mr. John B. Smith, Ant's nests and their inhabitants; Dr. T. H. Bean, The trout of North America, with exhibition of specimens; Mr. L. O. Howard, On some new Chalcididæ; Mr. L. F. Ward, Exhibition of a specimen of the Palo la Cruz or Wood of the Cross.

New York Academy of Sciences, May 10.—A history of the society from its beginning to the present time, prepared by the secretary, was presented. It comprised the following sections: Origin; membership; biographical sketches of prominent members; changes of location; the old Lyceum building; collections; library; publications; change of name, etc., etc. Some of the old documents, books, etc., were exhibited.

May 17.—The following paper was presented: Ten years' progress in astronomy, Professor C. A. Young, of Princeton College.

May 24.—The subject of the sanitary influence of vegetation in cities and the importance of tree-planting to the health, beauty and summer temperature of New York, with practical suggestions in relation thereto, was presented by Dr. Stephen Smith and Professor D. S. Martin.

May 31.—On rock-crystal, its cutting in Japan, Germany and the United States, with exhibition of crystal spheres and other objects of transparent quartz, including some of the largest pieces in this country, by Mr. George F. Kunz.

Boston Society of Natural History, May 19.—Mr. F. W. Putnam showed a collection of implements and ornaments from Central America, and remarked on the evidence they present of an early migration from Asia to America; Dr. C. S. Minot discussed the origin of the mesoderm.